

Douglas B. Clark

Professor of the Learning Sciences and Science Education
Peabody College of Education
Vanderbilt University

Box 230, 230 Appleton Place
Nashville, TN 37203-5721
doug.clark@vanderbilt.edu
(615) 322-5865

Areas of Specialization

At its core, my research focuses on the conceptual change processes through which students learn about complex causal relationships in science. This focal core informs, and is informed by, my research on technology-enhanced environments. Throughout, my goal involves leveraging students' intuitive understanding and supporting students in explicitly articulating their evolving understanding of complex scientific relationships.

Education

Ph.D. Education (Education in Mathematics, Science, and Technology), University of California-Berkeley, 2000

M.A. Education (Specialized in Science Education), Stanford University, 1991

B.A. Biology, University of North Carolina-Chapel Hill, 1989

Professional Experience

Full/Associate Professor at Vanderbilt University directing the LEAD lab and the SURGE group researching games and learning environments to promote science learning and conceptual change processes. Nashville, Tennessee. (2009-present, promoted to full professor 12/2014)

Associate/Assistant Professor at Arizona State University. Promoted to Associate Professor in 2008. Tempe, Arizona. (2002-2009)

Associate Director for the Center for Research in Education in Science, Mathematics, Engineering, and Technology (CRESMET) at Arizona State University. Tempe, Arizona. (2004-2008)

Lecturer/Postdoctoral Scholar at University of California at Berkeley. Berkeley, CA. (2001-2002)

Technology Plan Coordinator for UC Berkeley School of Education. Berkeley, CA. (2000-2001)

Middle School and High School Science Teacher. Arizona and California (1989-1994, part-time 1996-1998)

Honors and Awards

1. National Academy of Education/Spencer Postdoctoral Fellowship, 2006-2008
2. Outstanding Dissertation Award, UC Berkeley School of Education, 2001
3. National Science Foundation German-USA Early Career Research Exchange, 2001
4. National Science Foundation Science and Design Fellowship, 1999-2000
5. Berkeley Graduate Fellowship 1994-1998
6. Morehead Scholarship, University of North Carolina, 1984-1989
7. Chancellor's Award for Botany, University of North Carolina, 1989
8. North Carolina Fellow, 1984-1989

Honors and Awards - Students

1. My graduate student, Victor Sampson, won the Outstanding Dissertation Award from the National Association for Research on Science Teaching, 2008.

Journal Articles

1. Clark, D. B., Virk, S., Sengupta, P., Brady, C., Martinez-Garza, M., Krinks, K., Killingsworth, S., Kinnebrew, J., Biswas, G., Barnes, J., Minstrell, J., Nelson, B., Slack, K., & D'Angelo, C. (in press). SURGE's evolution deeper into formal representations: The siren's call of popular game-play mechanics. *International Journal of Designs for Learning*.
2. Virk, S. Clark, D. B., & Sengupta, P. (in press). Digital Games as Multirepresentational Environments for Science Learning: Implications for Theory, Research, and Design. *Educational Psychologist*.
3. Sengupta, P. & Clark, D. B. (in press). Playing Modeling Games in the Science Classroom: The Case for Disciplinary Integration. *Educational Technology*.
4. Kinnebrew, J., Killingsworth, S., Clark, D. B., Biswas, G., Sengupta, P., Minstrell, J., Martinez-Garza, M., & Krinks, K., (in press). Contextual Markup and Mining in Digital Games for Science Learning: Connecting Player Behaviors to Learning Goals. *IEEE Transactions on Learning Technologies*.
5. Sengupta, P., Krinks, K., & Clark, D. B. (2015). Learning to deflect: Conceptual change in

physics during digital game play. *Journal of the Learning Sciences*. 24(4), 638-674, DOI: 10.1080/10508406.2015.1082912

6. Killingsworth, S., Clark, D. B., & Adams, D. (2015). Self-explanation and explanatory feedback in games: individual differences, gameplay, and learning. *International Journal of Education in Mathematics, Science and Technology*. 3(3), 162-186.
http://ijemst.com/issues/3_3_1_Killingsworth_Clark_Adams.pdf
7. Clark, D. B., Tanner-Smith, E., & Killingsworth, S. (First Online 2015). Digital games, design, and learning: A systematic review and meta-analysis. *Review of Educational Research*. DOI: 10.3102/0034654315582065, first published on April 16, 2015.
<http://rer.sagepub.com/content/early/2015/10/20/0034654315582065.full.pdf+html>
8. Clark, D. B. & Martinez-Garza, M. (First Online 2015). Deep Analysis of Nuances and Epistemic Frames Around Argumentation and Learning in Informal Learning Spaces. *Computers in Human Behavior*.
9. Clark, D. B., Sengupta, P., Brady, C., Martinez-Garza, M., & Killingsworth, S. (2015). Disciplinary Integration in Digital Games for Science Learning. *International STEM Education Journal*, 2(2), 1-21. DOI 10.1186/s40594-014-0014-4.
<http://www.stemeducationjournal.com/content/pdf/s40594-014-0014-4.pdf>
10. Schleigh, S.P., Clark, D.B., & Menekse, M. (2015). Constructed-response as an alternative to interviews in conceptual change studies: Students' explanations of force. *International Journal of Education in Mathematics, Science and Technology*, 3(1), 14-36.
http://ijemst.com/issues/3.1.2.Schleigh_Clark_Menekse.pdf
11. Van Eaton, G., Clark, D.B., & Smith, B.E. (2015). Patterns of physics reasoning in face-to-face and online forum collaboration around a digital game. *International Journal of Education in Mathematics, Science and Technology*, 3(1), 1-13.
http://ijemst.com/issues/3.1.1.Van_Eaton_Clark_Smith.pdf
12. Clark, D. B., Menekse, M., Ozdemir, G., D'Angelo, C. M., & Schleigh, S. (2014). Exploring sources of variation in studies of knowledge structure coherence: Comparing force meanings and force meaning consistency across two Turkish cities. *Science Education*, 98(1), 143-181.
13. Adams, D. & Clark D. B. (2014). Integrating self-explanation functionality into a complex game environment: keeping gaming in motion. *Computers and Education*, 73, 149-159.
14. Martinez-Garza, M., Clark, D. B., & Nelson, B. (2013). Advances in assessment of students' intuitive understanding of physics through gameplay data. *International Journal of Gaming and Computer-Mediated Simulations*, 5(4), 1-16.
15. Martinez-Garza, M., Clark, D. B., & Nelson, B., (2013). Digital games and the US National Research Council's science proficiency goals. *Studies in Science Education*, 49(2), 170-208.
16. Sengupta, P., Kinnebrew, J., Basu, S., Biswas, G., & Clark, D. (2013). Integrating computational thinking with K12 science education using agent-based computation: A theoretical framework. *Education & Information Technologies*, 18(2), 351-380.

17. Clark, D. B., Touchman, S., Martinez-Garza, M., Ramirez-Marin, F., & Drews, C. S. (2012). Bilingual language supports in online science inquiry environments. *Computers and Education*, 58(4), 1207-1224.
18. Clark, D. B., D'Angelo, C. & Schleigh S. (2011). Comparison of students' knowledge structure coherence and understanding of force in the Philippines, Turkey, China, Mexico, and the United States. *Journal of the Learning Sciences*, 20(20), 207-261.
19. Clark, D. B., Nelson, B., Chang, H., D'Angelo, C. M., Slack, K. & Martinez-Garza, M., (2011). Exploring Newtonian mechanics in a conceptually-integrated digital game: Comparison of learning and affective outcomes for students in Taiwan and the United States. *Computers and Education*, 57(3), 2178-2195.
20. Sampson, V. D. & Clark, D. B. (2011). A Comparison of the collaborative scientific argumentation practices of two high and two low performing groups. *Research in Science Education*, 41(1), 63-97.
21. Clark, D. B., D'Angelo, C. M., & Menekse, M. (2009). Initial structuring of online discussions to improve learning and argumentation: Incorporating students' own explanations as seed comments versus an augmented-preset approach to seeding discussions. *Journal of Science Education and Technology*, 18(4), 321-333.
22. Ozdemir, G. & Clark, D. B. (2009). Knowledge structure coherence in Turkish students' understanding of force. *Journal of Research on Science Teaching*, 46(5), 570-596.
23. Sampson, V. D. & Clark, D. B. (2009). The impact of collaboration on the outcomes of scientific argumentation. *Science Education*, 93(3), 448-484.
24. Clark, D. B., & Sampson, V. D. (2008). Assessing dialogic argumentation in online environments to relate structure, grounds, and conceptual quality. *Journal of Research in Science Teaching*, 45(3), 293-321.
25. Sampson, V. D. & Clark, D. B. (2008). Assessment of the ways students generate arguments in science education: Current perspectives and recommendations for future directions. *Science Education*, 92(3), 447-72.
26. Clark, D. B., Reynolds, S., Lemanowski, V., Stiles, T., Yasar, S., Proctor, S., Lewis, E., Stromfors, C., & Corkins, J. (2008). University students' conceptualization and interpretation of topographic maps. *International Journal of Science Education*, 30(3), 377-408.
27. Clark, D., Sampson, V. D., Weinberger, A., & Erkens, G., (2007). Analytic frameworks for assessing dialogic argumentation in online learning environments. *Educational Psychology Review*, 19(3), 343-374.
28. Ozdemir, G. & Clark, D. B. (2007). An overview of conceptual change theories. *Eurasia Journal of Mathematics, Science, and Technology Education*, 3(4), 351-361.
29. Clark, D. B. & Sampson, V. D. (2007). Personally-Seeded Discussions to scaffold online argumentation. *International Journal of Science Education* 29(3), 253-277.

30. Weinberger, A., Clark, D., Häkkinen, P., Tamura, Y., & Fischer, F. (2007). Argumentative knowledge construction in online learning environments in and across different cultures: A collaboration script perspective. *Research in Comparative and International Education* 2(1), 68-79.
31. Medina-Jerez, W., Clark, D. B., & Ramirez-Marin, F. (2007). Science for ELL: Re-thinking our approach. *The Science Teacher*, 74(3), 52-56.
32. Sampson, V. D. & Clark, D. (2007). Incorporating scientific argumentation into inquiry-based activities with online personally-seeded discussions. *The Science Scope*, 30(6), 43-47.
33. Clark, D. B. (2006). Longitudinal conceptual change in students' understanding of thermal equilibrium: An examination of the process of conceptual restructuring. *Cognition and Instruction*, 24(4), 467-563.
34. Simons, K., & Clark, D. B. (2004). Supporting inquiry in science classrooms with the web. *Computers in the Schools* 3/4(21), 23-36.
35. Clark, D. B., & Jorde, D. (2004). Helping students revise disruptive experientially supported ideas about thermodynamics: Computer visualizations and tactile models. *Journal of Research in Science Teaching* 41(1), 1-23.
36. Clark, D. B. & Fischer, F. (2003). Learning through online collaborative discourse. *The International Journal of Educational Policy, Research and Practice*, IV(1), 11-16.
37. Clark, D. B., & Linn, M. C. (2003). Designing for knowledge integration: the impact of instructional time. *Journal of Learning Sciences*, 12(4), 451-493.
38. Clark, D. B., Weinberger, A., Jucks, I., Spitulnik, M., & Wallace, R. (2003). Designing effective science inquiry in text-based computer-supported collaborative learning environments. *The International Journal of Educational Policy, Research and Practice*, IV(1), 55-82.
39. Linn, M. C., Clark, D. B., & Slotta, J. D. (2003). WISE design for knowledge integration. *Science Education*, 87(4), 517-538.
40. Spitulnik, M., Bouillion, E., Rummel, N., Clark, D. B., Fischer, F. (2003). Collaborative online environments for lifelong learning: design issues from a situated learning perspective. *The International Journal of Educational Policy, Research and Practice*, IV(1), 83-116.
41. Clark, D. B., & Slotta, J. D. (2000). Evaluating media-enhancement and source authority on the internet: the Knowledge Integration Environment. *International Journal of Science Education*, 22(8), 859-871.

Chapters in Books.

1. Clark, D. B., Sengupta, P. & Virk, S. (in press). Disciplinarily-integrated games: Generalizing across domains and model types. Chapter in D. Russell and J. Laffey

- (Eds.) *Handbook of Research on Gaming Trends in P-12 Education*. Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9629-7
2. Killingsworth, S., Adams, D., & Clark, D. B. (accepted). Learning, cognition, and experimental control in an educational physics game. R. Lamb and D. McMahon (Eds.) *Educational and Learning Games: New Research*. Nova Science Publishers.
 3. Martinez-Garza, M., Clark, D. B., Killingsworth, S., & Adams, D. (in press). Beyond fun: Pintrich, motivation to learn, and games for learning. Chapter in D. Russell and J. Laffey (Eds.) *Handbook of Research on Gaming Trends in P-12 Education*. Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9629-7
 4. Van Eaton, G. & Clark, D. B. (in press). Designing Digital Objects to Scaffold Learning. Chapter in D. Russell and J. Laffey (Eds.) *Handbook of Research on Gaming Trends in P-12 Education*. Hershey, PA: IGI Global. doi:10.4018/978-1-4666-9629-7
 5. Clark, D. B., Nelson, B., Atkinson, R., Ramirez-Marin, F., & Medina, W. (2015). Integrating flexible language supports within online science learning environments. T. Ganesh, A. Boriack, J. Stillisano, T. Davis, & H. Waxman (Eds.) *Technology use in multicultural settings* (pp. 75-105). Charlotte, NC: Information Age.
 6. Martinez-Garza, M., & Clark, D. B. (2015). Games for learning. In R. Gunstone (Ed.), *Encyclopedia of Science Education* (pp. 437-440). Dordrecht: Springer.
 7. Clark, D. B. & Linn, M. C. (2013). The knowledge integration perspective: connections across research and education. In S. Vosniadou (Ed.) *International Handbook of Research on Conceptual Change (2nd Edition)* (pp. 520-538). New York: Routledge.
 8. Clark, D. B., & Sengupta, P. (2013). Argumentation and modeling: Integrating the products and practices of science to improve science education. In M. Khine & I. Saleh (Eds.), *Approaches and Strategies in Next Generation Science Learning* (pp. 85-105). Hershey, PA: IGI Global/Information Science References doi:10.4018/978-1-4666-2809-0.ch005.
 9. Ramirez-Marin, F. & Clark, D. B. (2013). Academic language in science for English learners. Arias, MB and Faltis, C. (Eds.), *Academic Language in Second Language Learning* (pp. 171-200). Charlotte, NC: Information Age Publishing.
 10. Martinez-Garza, M., & Clark, D. B. (2013). Teachers and teaching in game-based learning theory and practice. In M. Khine & I. Saleh (Eds.), *Approaches and Strategies in Next Generation Science Learning* (pp. 147-163). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-2809-0.ch008.
 11. Chinn, C., & Clark, D. B. (2013). Learning through collaborative argumentation. In Hmelo-Silver, C. E., Chinn, C. A., Chan, C. K. K., & O'Donnell, A. M. (Eds.) *International Handbook of Collaborative Learning* (pp. 314-332). New York: Routledge.

12. Clark, D. B., & Martinez-Garza, M. (2012). Prediction and explanation as design mechanics in conceptually-integrated digital games to help players articulate the tacit understandings they build through gameplay. In C. Steinkuhler, K. Squire, & S. Barab (Eds.), *Games, Learning, And Society: Learning And Meaning In The Digital Age* (pp. 279-305). Cambridge: Cambridge University Press.
13. Clark, D. B., Martinez-Garza, M., Biswas, G., Luecht, R. M., & Sengupta, P. (2012). Driving assessment of students' explanations in game dialog using computer-adaptive testing and hidden Markov Modeling. In D. Ifenthaler, D. Eseryel, & G. Xun (Eds.). *Game-based Learning: Foundations, Innovations, and Perspectives* (pp. 173-199). New York: Springer.
14. Clark, D. B., Sampson, V. D., Chang, H., Zhang, H., Tate, E., & Schwendimann, B. (2011). Research on critique and argumentation from the Technology Enhanced Learning in Science Center. In M. Khine (Ed.) *Perspectives on Scientific Argumentation: Theory, Practice and Research* (pp. 157-200). The Netherlands: Springer.
15. Jeong, A., Clark, D. B., Sampson, V. D., & Menekse, M. (2010). Sequential analysis of scientific argumentation in asynchronous online discussion environments. S. Puntambekar, G. Erkens, & C. Hmelo-Silver (Eds.), *Analyzing Interactions in CSCL (Computer-Supported Collaborative Learning Series): Methods, Approaches and Issues* (pp. 207-234). The Netherlands: Springer.
16. Clark, D. B., Sampson, V. D., Stegmann, K., Marttunen, M., Kollar, I., Janssen, J., Weinberger, A., Menekse, M., Erkens, G., & Laurinen, L. (2010). Online learning environments, scientific argumentation, and 21st century skills. In B. Ertl (Ed.) *E-Collaborative Knowledge Construction: Learning from Computer-Supported and Virtual Environments* (pp. 1-39). New York: IGI Global.
17. Clark, D. B., Varma, K., McElhaney, K., & Chiu, J. (2008). Design rationale within TELS projects to support knowledge integration. D. Robinson & G. Schraw (Eds.), *Recent Innovations in Educational Technology that Facilitate Student Learning* (pp. 157-193). Charlotte, NC: Information Age Publishing.
18. Tate, E., Clark, D. B., Gallagher, J., & McLaughlin, D. (2008). Designing science instruction for diverse learners. In Y. Kali, M. C. Linn, & J. E. Roseman (Eds.), *Designing Coherent Science Education* (pp. 65-93). New York: Teachers College Press.
19. Clark, D. B. & Chaudury, S. R. (2008). Creating coherent inquiry projects to support student cognition and collaboration in physics. J. Luft, R. Bell, & J. Gess-Newsome (Eds.), *Science as Inquiry in the Secondary Setting* (pp. 65-77). Arlington, VA: National Science Teacher Association Press.
20. Clark, D. B., Stegmann, K., Weinberger, A., Menekse, M., & Erkens, G. (2008). Technology-enhanced learning environments to support students' argumentation. In S. Erduran & M. P. Jiménez-Aleixandre (Eds.), *Argumentation in science education: Perspectives from Classroom-based Research* (pp. 217-243). Dordrecht: Springer.
21. D'Angelo, C. M., Touchman, S., & Clark, D. B. (2008). Overview of constructivism. In E.

- M. Anderman & L. H. Anderman (Eds.) *Psychology of Classroom Learning: An Encyclopedia* (Volume 1. pp. 262-267). New York: MacMillan Reference.
22. Baker, D., Piburn, M., & Clark, D. B. (2005). TEAMS: Working together to improve teacher education. In R. Yager (Ed.), *Exemplary Science: Best Practices in Professional Development* (pp. 35-44). Arlington, VA: NSTA Press.
 23. Clark, D. B. (2004). Hands-on investigation in Internet environments: Teaching thermal equilibrium. In M. C. Linn, E. A. Davis., & P. Bell (Eds.), *Internet Environments for Science Education* (pp. 175-200). Mahwah, NJ: Lawrence Erlbaum Associates.
 24. Clark, D. B., & Slotta, J. D. (2004). Web-based Inquiry Science Environment (WISE). In A. Kovalchick & K. Dawson (Eds.), *Education & Technology: An Encyclopedia* (Vol. 2, pp. 630-638). Santa Barbara, CA: ABC-CLIO.
 25. Cuthbert, A. J., Clark, D. B., & Linn, M. C. (2002). WISE learning communities: Design considerations. In K.A. Renninger & W. Shumar (Eds.), *Building Virtual Communities: Learning and Change in Cyberspace* (pp. 215-246). Cambridge: Cambridge University Press.

Dissertation

1. Clark, D. B. (2000). *Scaffolding knowledge integration through curricular depth*. Unpublished doctoral dissertation. University of California at Berkeley.

Invited and Commissioned Reports, Papers, and Keynotes

1. Clark, D. B. (2013). Invited keynote speaker for the 16th International Conference on Artificial Intelligence in Education (AIED 2013). Memphis, TN.
2. Clark, D. B., Tanner-Smith, E., & Killingsworth, S. (2013). *Digital games for learning: A systematic review and meta-analysis (preliminary executive summary and brief)*. Report commissioned by The Bill and Melinda Gates Foundation.
<http://www.sri.com/work/projects/glasslab-research>
3. Clark, D. B. (2013). Invited keynote speaker for the Annual Conference of the Research Center for Innovation in Learning Technologies at the Open University of Israel (CHAIS 2013). <http://www.youtube.com/watch?v=2jaznkUOW6E>
4. Clark, D. B. (2012). Designing Games to Help Players Articulate Productive Mental Models. Keynote commissioned for the Cyberlearning Research Summit 2012 hosted by SRI International, the National Geographic Society, and the Lawrence Hall of Science with funding from the National Science Foundation and the Bill and Melinda Gates Foundation. Washington, DC. <http://www.youtu.be/xlMfk5rP9yI>
5. Clark, D. B. (2011). Games and Simulations Bridging Intuitive and Formal Understandings

of Physics. Keynote commissioned by the Gordon Research Conference on Visualization, Smithfield, Rhode Island.

6. Clark, D. B. (2011). What Now? Argumentation, Inquiry, and Technology. Keynote commissioned by the National Science Education Leadership Association, Johnson City, Tennessee.
7. Clark, D. B., Nelson, B., Sengupta, P., D'Angelo, C. M. (2009). Rethinking Science Learning Through Digital Games and Simulations: Genres, Examples, and Evidence. Paper commissioned for the National Research Council Workshop on Games and Simulations. Washington, D.C.
8. Clark, D. B., Sampson, V. D., Stegmann, K., Marttunen, M., Kollar, I., Janssen, J., Weinberger, A., Menekse, M., Erkens, G., & Laurinen, L. (2009). Scaffolding scientific argumentation between multiple students in online learning environments to support the development of 21st century skills. Paper commissioned for the National Research Council Workshop Exploring the Intersection of Science Education and the Development of 21st Century Skills. Washington, D.C.

Work in Preparation

1. Clark, D. B., Virk, S., Barnes, J., Adams, D., and Killingsworth, S. S. (in preparation). Self-Explanation Functionality to Enhance Reflection in Games through Game Dialog.
2. Basu, S., Sengupta, P., Dickes, A., Biswas, G., Kinnebrew, J., & Clark, D. (submitted). Investigating learner interactions with a computational thinking based learning environment for middle school science: Challenges faced and scaffolds required. *Educational Technology Research & Development*.
3. Martinez-Garza, M. & Clark, D. B. (in revision). Two systems, two stances: a novel theoretical framework for model-based learning in digital games. Submitted to *Educational Psychologist*.
4. Van Eaton, G., Clark, D. B., & Sengupta, P. (in preparation). A Multispatial Analysis of Representation Creation.
5. Adams, D. & Clark, D. B. (in preparation). Scaffolding student game play and learning through worked examples.
6. Martinez-Garza, M. & Clark, D. B. (in preparation). Data-mining epistemic stances from raw game-play data.
7. Virk, S., Clark, D. B., & Killingsworth, S. S. (in preparation). Comparison of video and word problem based embedded scaffolds to support student reflection and learning during game play.

8. Sengupta, P., Clark, D. B., Krinks, K., Killingsworth, S., & Brady, C. (In preparation). From trajectories to change in speed: Learning physics through representational translation in video games.
9. Sengupta, P. & Clark, D. B. (in preparation). Disciplinarily-integrated games: Shifting from perceptual and cognitive to developmental trajectories across the curriculum.
10. Krinks, K., Sengupta, P., & Clark, D. B. (in preparation). Benchmark Lessons, Modeling, and Programming: Integrating Games With Modeling in the Curriculum.
11. Killingsworth, S., Kinnebrew, J., Clark, D. B., Biswas, G., & Barnes, J. (in preparation). Triangulating Data-mining with Cognitive Correlates in Digital Games to Predict Learning and Optimal Pathways.
12. Barnes, J. & Clark, D. B. (in preparation). Designing for the diversity of users within an educational game. In M. Young & S. Slota (Eds.), *Exploding the Castle: Rethinking How Video Games & Game Mechanics Can Shape the Future of Education*. Information Age Publishers.

Published Conference Proceedings

1. Clark, D. B., Virk, S., & Sengupta, P. (2015). Disciplinarily-Integrated Games: A Generalizable Genre? *Proceedings of Games, Learning, and Society 2015*. Madison, WI.
2. Clark, D. B., Tanner-Smith, E., & Killingsworth, S. (2015). The Good, the Bad, and the Role of Design: A Systematic Review and Meta-Analysis. *Proceedings of Games, Learning, and Society 2015*. Madison, WI.
3. Sengupta, P., Clark, D. B., Brady, C., Killingsworth, S., & Krinks, K. (2014). Integarting Modeling with Digital Games for Learning Physics. Paper presented at the International Conference of the Learning Sciences (ICLS) 2014 meeting. Boulder, CO.
4. Martinez-Garza, M., & Clark, D. B. (2014). Two Systems, Two Stances: A Novel Theoretical Framework for Game-Based Learning. *Proceedings of the Eleventh International Conference of the Learning Sciences*. Boulder, CO.
5. Johnson-Glenberg, M., Perkins, K., Lindgren, R., Clark, D. B., Holbert, N., Squire, K., & Gaydos, M. (2014). Science Sims and Games: Best Design Practices. To be included in the *Proceedings of the Eleventh International Conference of the Learning Sciences*. Boulder, CO.
6. Killingsworth, S. & Clark, D. B. (2013). Connecting Learning Goals and Component Cognitive Skills in Digital Games. In M. Knauff, M. Pauen, N. Sebanz, & I. Wachsmuth (Eds.), *Proceedings of the 35th Annual Conference of the Cognitive Science Society*. Berlin, Germany: Cognitive Science Society.

7. Clark, D. B. (July 2013). Games, Motivation, and Integrating Intuitive and Formal Understanding. Invited keynote speaker for the 16th International Conference on Artificial Intelligence in Education (AIED 2013). Memphis, TN.
8. Clark, D. B., Killingsworth, S., Martinez-Garza, M., Van Eaton, G., Biswas, G., Kinnebrew, J., Sengupta, P., Krinks, K., Adams, D., Zhang, H., & Hughes, J. (2013). Digital Games and Science Learning: Design Principles and Processes to Augment Commercial Game Design Conventions. Full Workshop Paper for the 16th International Conference on Artificial Intelligence in Education (AIED 2013). Memphis, TN.
9. Van Eaton, G., Clark, D. B., & Beutel, D. (2013). Designing Digital Objects to Scaffold Learning. Short Workshop Paper for the 16th International Conference on Artificial Intelligence in Education (AIED 2013). Memphis, TN.
10. Clark, D. B., Smith, B., Zuckerman, S., Wilson, S. C., Ssebikindu, J., & van Eaton, G. (2013). Levels of Articulated Reasoning In Spontaneous Face-To-Face Collaborations and Online Forum Postings Surrounding a Single-Player Physics Game in Public Middle School Classrooms. In Proceedings of the Computer Supported Collaborative Learning (CSCL) conference 2013, Madison, WI.
11. Sengupta, P., Kinnebrew, J., Biswas, G., & Clark, D.C. (2012). Integrating Computational Thinking with K-12 Science Education: A Theoretical Framework. In Proceedings of the International Conference on Computer Supported Education (CSEDU 2012). Vol 2, pp. 40-49.
12. Linn, M. C., & Clark, D. B. (2012). Synergies in conceptual change perspectives. Paper presented as part of symposium organized by S. Vosniadou titled "Instructional Approaches to Promote Conceptual Change." *Proceedings of the Tenth International Conference of the Learning Sciences*. Sydney, Australia.
13. Clark, D. B., Nelson, B., D'Angelo, C. M., Slack, K. & Martinez-Garza, M., (2010). SURGE: Integrating Vygotsky's Spontaneous and Instructed Concepts in a Digital Game. *Proceedings of the Ninth International Conference of the Learning Sciences*, 384-385. Chicago, IL.
14. Clark, D. B., Nelson, B. C., D'Angelo, C. M., Slack, K., Menekse, M., & Martinez-Garza, M. (2010). *Comparing the impact of overlaying physics-based video games with formal physics representations in Taiwan and the United States*. National Association of Research in Science Teaching (NARST) 2010 meeting. Philadelphia, Pennsylvania.
15. Menekse, M., Clark, D. B., Ozdemir, G., D'Angelo, C. M., & Schleigh, S. (2009). Turkish students' force meanings. *Proceedings of the European Science Education Research Association (ESERA) Conference 2009*. Istanbul, Turkey.
16. Clark, D. B., D'Angelo, C. M., & Schleigh, S. (2009). Analyzing differences and similarities in students' knowledge structure coherence and understanding of force. Individual paper presented at the National Association of Research in Science Teaching (NARST) 2009 meeting. Garden Grove, CA.

17. Clark, D. B., Menekse, M., D'Angelo, C. M., & Schleigh, S. (2009). Conflict schemas: Structuring online discussions to enhance learning. Paper presented as part of an organized symposium at the National Association of Research in Science Teaching (NARST) 2009 meeting. Garden Grove, CA.
18. Touchman, S., Clark, D. B., & Skjerpung, C. (2009). Learning science and English using native-language aids. Individual paper presented at the National Association of Research in Science Teaching (NARST) 2009 meeting. Garden Grove, CA.
19. Clark, D. B., D'Angelo, C. M., & Schleigh, S. (2008). International comparison of knowledge structure coherence: Cultural, semantic, and educational differences. *Proceedings of the Eighth International Conference of the Learning Sciences*.
20. Schleigh, S., Clark, D. B., D'Angelo, C. M. (2008). The impact of gender on conceptual theoretical framework and cognition across cultures. *Proceedings of the National Association of Research in Science Teaching Conference 2006*. Baltimore, MD.
21. Clark, D. B., Schleigh, S., D'Angelo, C. M., Ozdemir, G., Menekse, M., Zhang, Z., & Corpuz, E. (2008). Cross-cultural analysis of knowledge structure coherence and understanding of force. *Proceedings of the National Association of Research in Science Teaching Conference 2006*. Baltimore, MD.
22. Sampson, V. & Clark, D. B. (2008). Differences in the ways more and less successful groups engage in argumentation: A case study. *Proceedings of the National Association of Research in Science Teaching Conference 2006*. Baltimore, MD.
23. Clark, D., Sampson, V., Weinberger, A., & Erkens, G., (2007). Evaluating the quality of dialogical argumentation in CSCL: Moving beyond an analysis of formal structure. *Proceedings of the Computer Supported Collaborative Learning (CSCL) Conference 2007*. Rutgers, NJ.
24. Weinberger, A., Clark, D., Dillenbourg, P., Diziol, D., Sampson, V., Stegmann, K., Rummel, N., Hong, F., Spada, H., McLaren, B., Brahm, T., & Fischer, F. (2007). Orchestrating learning activities on the social and the cognitive level to foster CSCL. *Proceedings of the Computer Supported Collaborative Learning (CSCL) Conference 2007*. Rutgers, NJ.
25. Sampson, V. & Clark, D. B. (2006). Assessment of Argument in Science Education: A Critical Review of the Literature. *Proceedings of the Seventh International Conference of the Learning Sciences - Making a Difference*. Mahwah, NJ: Erlbaum.
26. Weinberger, A., Clark, D., Erkens, G., Sampson, V., Stegmann, K., Janssen, J., Jaspers, J., Kanselaar, G., & Fischer, F. (2006). Argumentative knowledge construction in CSCL. In S. A. Barab, K. E. Hay & D. T. Hickey (Eds.), *Proceedings of the Seventh International Conference of the Learning Sciences - Making a Difference* (pp. 1094-1100). Mahwah, NJ: Erlbaum.
27. Lemanowski, V., Yasar, S., Reynolds, S., & Clark, D. (2006). The evolution of a test item: Using item analysis to build a better geology test. *Proceedings of the National Association of*

Research in Science Teaching Conference 2006. San Francisco, California.

28. Sampson, V. & Clark, D. B. (2006). The development and validation of the Nature of Science as Argument Questionnaire (NSAAQ). *Proceedings of the National Association of Research in Science Teaching Conference 2006*. San Francisco, California.
29. Clark, D. B., & Sampson, V. (2006). Characteristics of students' argumentation practices when supported by online personally-seeded discussions. *Proceedings of the National Association of Research in Science Teaching Conference 2006*. San Francisco, California.
30. Clark, D. B., & Sampson, V. (2005). Analyzing the quality of argumentation supported by personally-seeded discussions. *Proceedings of the Computer Supported Collaborative Learning (CSCL) Conference 2005*. Taipei, Taiwan.
31. Clark, D. B., Corkins, J., Lemanowski, V., Stromfors, C., Stiles, T., Yasar, S., Reynolds, S., Joshua, M., Brown, M., & Proctor, S. (2004). *Interpreting topographic maps: Strategies and assumptions of university students*. National Association of Research in Science Teaching Conference Proceedings, Vancouver, BC, Canada, CD-ROM.
32. Clark, D. B. (2003). *Analyzing student knowledge integration: Theories or pieces?* National Association of Research in Science Teaching Conference, Philadelphia, PA, CD-ROM.
33. Slotta, J. D., Clark, D. B., & Cheng, B. (2002). Integrating Palm hand-held technology into the Web-based Inquiry Science Environment (WISE). *Proceedings of the Computer Supported Collaborative Learning (CSCL) Conference 2002*. Boulder, Colorado.

Conference Presentations

1. Clark, D. B., Virk, S., & Sengupta, P. (2015). Disciplinarily-Integrated Games: A Generalizable Genre? Paper presented at Games, Learning, and Society 2015. Madison, WI.
2. Clark, D. B., Tanner-Smith, E., & Killingsworth, S. (2015). The Good, the Bad, and the Role of Design: A Systematic Review and Meta-Analysis. Paper presented at Games, Learning, and Society 2015. Madison, WI.
3. Krinks, K., Sengupta, P., & Clark, D. B. (2015). Benchmark Lessons: Integrating Modeling with Games for Learning Physics. Paper presented at the annual meeting of the American Educational Research Association. Chicago, IL.
4. Van Eaton, G. Clark, D. B., Smith, B. (2015). Face-to-Face Collaboration, Online Forums, and Physics Reasoning Around a Digital Game in the Classroom. Poster presented at the American Educational Research Association (AERA) 2015 meeting. Chicago, IL.
5. Clark, D. B., Tanner-Smith, E., & Killingsworth, S. (2015). Digital Games, Design, and Learning: A Systematic Review and Meta-Analysis. Poster presented at the American Educational Research Association (AERA) 2015 meeting. Chicago, IL.

6. Van Eaton, G., Clark, D. B., Smith, B. (2015). Face-to-Face Collaboration, Online Forums, and Physics Reasoning Around a Digital Game in the Classroom. Poster presented at the annual meeting of the National Association for Research in Science Teaching. Chicago, IL.
7. Krinks, K., Sengupta, P., & Clark, D. B. (2015). Benchmark Lessons: Integrating Modeling with Games for Learning Physics. Paper presented at the annual meeting of the National Association for Research in Science Teaching. Chicago, IL.
8. Clark, D. B., Brady, C., Sengupta, P., Martinez-Garza, M., Adams, D., Killingsworth, S., & Van Eaton, G. (2014). Evolving and Balancing Informal and Formal Representations. Paper presented at the International Conference of the Learning Sciences (ICLS) 2014 meeting. Boulder, CO.
9. Martinez-Garza, M., & Clark, D. B. (2014). Two Systems, Two Stances: A Novel Theoretical Framework for Game-Based Learning. Poster presented at the International Conference of the Learning Sciences (ICLS) 2014 meeting. Boulder, CO.
10. Sengupta, P., Killingsworth, S., Krinks, K., Brady, C., & Clark, D. B. (2014). Integrating Modeling with Games for Learning Newtonian Mechanics. Paper presented at the International Conference of the Learning Sciences (ICLS) 2014 meeting. Boulder, CO.
11. Van Eaton, G., Clark, D. B., & Beutel, D. (2014). Designing Digital Objects to Elicit Conceptual Change. Poster presented at the American Educational Research Association (AERA) 2014 meeting. Philadelphia, PA.
12. Martinez-Garza, M., & Clark, D. B. (2014). Digital Games and Science Proficiency Goals. Paper presented at the American Educational Research Association (AERA) 2014 meeting. Philadelphia, PA.
13. Adams, D. M., & Clark, D. B. (2014). Examining the Effect of Self-Explanation and Explanatory Feedback on a Cognitively Demanding Educational Physics Game. Paper presented at the American Educational Research Association (AERA) 2014 meeting, Philadelphia, PA.
14. Clark, D. B. (July 2013). Games, Motivation, and Integrating Intuitive and Formal Understanding. Invited keynote speaker for the 16th International Conference on Artificial Intelligence in Education (AIED 2013). Memphis, TN.
15. Clark, D. B., Killingsworth, S., Martinez-Garza, M., Van Eaton, G., Biswas, G., Kinnebrew, J., Sengupta, P., Krinks, K., Adams, D., Zhang, H., & Hughes, J. (2013). Digital Games and Science Learning: Design Principles and Processes to Augment Commercial Game Design Conventions. Full Workshop Paper for the 16th International Conference on Artificial Intelligence in Education (AIED 2013). Memphis, TN.
16. Van Eaton, G., Clark, D. B., & Beutel, D. (2013). Designing Digital Objects to Scaffold Learning. Short Workshop Paper for the 16th International Conference on Artificial Intelligence in Education (AIED 2013). Memphis, TN.

17. Killingsworth, S. S. & Clark, D. B. (2013). Connecting Learning Goals and Component Cognitive Skills in Digital Games. In M. Knauff, M. Pauen, N. Sebanz, & I. Wachsmuth (Eds.), Proceedings of the 35th Annual Conference of the Cognitive Science Society. Berlin, Germany: Cognitive Science Society.
18. Clark, D. B., Tanner-Smith, E., & Killingsworth, S. (2013). Meta-Analysis of Digital Games and Learning In Terms of the NRC's Education for Life and Work Outcomes. Paper presented at Games, Learning, and Society (GLS) 2013. Madison, WI.
19. Linn, M. C., & Clark, D. B. (2013). Synergies in conceptual change perspectives. Paper presented as part of symposium titled "Promoting Conceptual Change: Theoretical and Instructional Perspectives" at the American Educational Research Association (AERA) 2013. San Francisco, CA.
20. Ramirez-Marin, F., & Clark, D. B. (2013). Academic Language and Science Content. Paper presentation as part of session titled "Academic Language and the Language of Poverty: Clarifying the Construct" at the American Educational Research Association (AERA) 2013. San Francisco, CA.
21. Clark, D. B., Smith, B., Zuckerman, S., Wilson, S. C., Ssebikindu, J., & van Eaton, G. (2013). Levels of Articulated Reasoning In Spontaneous Face-To-Face Collaborations and Online Forum Postings Surrounding a Single-Player Physics Game in Public Middle School Classrooms. Proceedings of the Computer Supported Collaborative Learning (CSCL) conference 2013, Madison, WI.
22. Clark, D. B., Krinks, K., Kinnebrew, J., Sengupta, P., Hughes, J., Martinez-Garza, M., Killingsworth, S., Biswas, G., Van Eaton, G., & Zhang, H. (2013). Design Matters: Research on Game Design for Science Learning. Poster presented at the National Association of Research in Science Teaching (NARST) 2013 meeting. Rio Grande, Puerto Rico.
23. Clark, D. B., Smith, B., Zuckerman, S., Wilson, S. C., Ssebikindu, J., & van Eaton, G. (2013). Games, Collaboration, and Physics: How the Structures of Informal Collaboration Affect Learning. Paper presented at the National Association of Research in Science Teaching (NARST) 2013 meeting. Rio Grande, Puerto Rico.
24. Krinks, K. D., Sengupta, P., Clark, D. B. (2013, April). Conceptual Change in Physics Through Use of Digital Games. Paper presented at annual conference of the National Association for Research in Science Teaching, Rio Mar, Puerto Rico.
25. Clark, D. B. (2013). Invited keynote speaker for the Annual Conference of the Research Center for Innovation in Learning Technologies at the Open University of Israel (CHAIS 2013). <http://www.youtube.com/watch?v=2jaznkUOW6E>
26. Sengupta, P., Kinnebrew, J.S., Biswas, G., & Clark, D.C. (2012). Integrating Computational Thinking with K-12 Science Education: A Theoretical Framework. In Proceedings of the International Conference on Computer Supported Education (CSEDU 2012). Vol 2, pp. 40-49.

27. Linn, M. C., & Clark, D. B. (2012). Synergies in conceptual change perspectives. Paper presented as part of symposium organized by S. Vosniadou titled "Instructional Approaches to Promote Conceptual Change." Proceedings of the Tenth International Conference of the Learning Sciences. Sydney, Australia.
28. Clark, D. B., Killingsworth, S., Hughes, J., Krinks, K., Kinnebrew, J., Martinez-Garza, M., Sengupta, P., Biswas, G. (2012). Scaffolding integration of intuitive and formal understanding within and around games. Talk presented as part of an organized symposium at the Discovery Research K-12 (DR-K12) 2012 meeting. Arlington, VA.
29. Clark, D. B., Lim-Breitbart, J., Terashima, H., Kwan, G. & Martinez-Garza, M., (2012). SURGE: Designing A Distributed Collaborative Framework for Research on Games and Simulations In Schools. Poster presented as part of a thematic session at Discovery Research K-12 (DR-K12) 2012 meeting. Arlington, VA.
30. Clark, D. B., Killingsworth, S., Hughes, J., Krinks, K., Kinnebrew, J., Martinez-Garza, M., Sengupta, P., Biswas, G. (2012). SURGE: Research Underway and In The Works. Poster presented at the Discovery Research K-12 (DR-K12) 2012 meeting. Arlington, VA.
31. Clark, D. B., Martinez-Garza, M. M., Biswas, G., Luecht, R. M., & Sengupta, P. (2012). Driving assessment of students' explanations of in game dialog using computer-adaptive testing and hidden Markov modeling. In Dirk Ifenthaler (Chair). Assessment in game-based learning. Symposium conducted at the 2012 AECT Convention of the Association for Educational Communications and Technology, Louisville, KY.
32. Martinez-Garza, M. M., & Clark, D. B. (2012, June). Teachers and teaching in game-based learning teaching and practice. Poster presented at Games, Learning, and Society 8.0, Madison, WI.
33. Clark, D. B., Lim-Breitbart, J., Terashima, H., Kwan, G. & Martinez-Garza, M., (2012). SURGE and WISE: A framework that works in real schools. Talk presented as part of a thematic session at Discovery Research K-12 (DR-K12) 2012 meeting. Arlington, VA.
34. Clark, D. B., Martinez-Garza, M., Hughes, J., Krinks, K., Kinnebrew, J., Sengupta, P., Biswas, G., & Barrett, J. (2012). Beyond Good and Evil: Game design for explicit articulation of mental models. Presentation at invited symposium at the National Association of Research in Science Teaching 2012 meeting. Indianapolis, IN.
35. D'Angelo, C. M., Clark, D. B. & Shaffer, D. W. (2012). Epistemic Network Analysis: An Alternative Analysis Technique for Complex STEM Thinking. Symposium presentation at the National Association of Research in Science Teaching (NARST) 2012 meeting. Indianapolis, IN.
36. Clark, D. B., Martinez-Garza, M. M., Biswas, G., Luecht, R. M., & Sengupta, P. (2012). Scaffolding and Assessing Students' Explanations in Game Dialog With Hidden Markov Modeling and Computer Adaptive Testing Techniques. Paper presented at the 2012 annual meeting of the American Educational Research Association, Vancouver, BC, Canada.

37. Clark, D. B. (2012). EGAME SURGE. Presentation/Demonstration in Session titled "Embedded Assessment in Innovative Digital Learning Environments" at the 2012 annual meeting of the American Educational Research Association, Vancouver, BC, Canada.
38. Martinez-Garza, M. M., Clark, D. B., Nelson, B. C., Slack, K., & D'Angelo, C. M. (2012, April). Investigating cognitive factors that mediate learning in the context of a physics-based game. Paper presented at the 2012 annual meeting of the American Educational Research Association, Vancouver, BC, Canada.
39. Clark, D. B. (2012). Designing Games to Help Players Articulate Productive Mental Models. Talk commissioned for the Cyberlearning Research Summit 2012 hosted by SRI International, the National Geographic Society, and the Lawrence Hall of Science with funding from the National Science Foundation and the Bill and Melinda Gates Foundation. Washington, DC.
40. Clark, D. B. (2011). Games and sims bridging intuitive and formal understandings of physics. Talk commissioned by the Gordon Research Conference on Visualization, Smithfield, Rhode Island.
41. Clark, D. B. (2011). What Now? Argumentation, Inquiry, and Technology. Keynote commissioned by the National Science Education Leadership Association, Johnson City, Tennessee.
42. Clark, D. B., Nelson, B., Chang, H., D'Angelo, C. M., Slack, K., & Martinez-Garza, M., (2011). Exploring Newtonian Mechanics in a Conceptually-Integrated Digital Game: Comparison of Learning and Affective Outcomes for Students in Taiwan and the United States. Paper presented at the Games, Learning, & Society Conference 7.0, Madison, WI.
43. Martinez-Garza, M., Clark, D. B., Nelson, B., Slack, K., & D'Angelo, C. (2011, June). *Novel approaches to gameplay data analysis as an assessment of learning*. Paper presented at the Games, Learning, & Society Conference 7.0, Madison, WI.
44. D'Angelo, C. M. (2011). *Analyzing STEM thinking with epistemic network analysis*. Paper presented at the Cyberlearning Tools for STEM Education Conference. Berkeley, CA.
45. Clark, D. B., Nelson, B., Martinez-Garza, M., Slack, K., & Garvey, D. (2011). Scaffolding Student Metacognition About Connections Between Intuitive Ideas and Formal Concepts In Conceptually-Integrated Digital Games. Paper presented at the Jean Piaget Society 2011 meeting. Berkeley, CA.
46. Slack, K., Nelson, B., Clark, D. B., & Martinez-Garza, M. (2011). Model-Based Thinking in the Scaffolding Understanding by Redesigning Games for Education (SURGE) Project. Poster presented as part of a structured poster session at the American Educational Research Association (AERA) 2011 meeting. New Orleans, LA.
47. Martinez-Garza, M., Clark, D. B., Nelson, B., & Slack, K. (2011). Assessing Students' Intuitive Understanding of Physics Through Game Play Data. Paper presented at the American Educational Research Association (AERA) 2011 meeting. New Orleans, LA.

48. Clark, D. B. (2011). Learning Technologies in Informal Contexts. Panelist/Presenter in session presented at the National Association of Research in Science Teaching 2011 meeting. Orlando, FL.
49. Clark, D. B., Nelson, B., Martinez-Garza, M., Slack, K., & D'Angelo, C. M. (2011). Prediction and Explanation as Design Mechanics in Conceptually-Integrated Digital Games to Help Players Articulate the Tacit Understandings they Build Through Gameplay. Poster presented as part of a structured poster session at the National Association of Research in Science Teaching 2011 meeting. Orlando, FL.
50. Clark, D. B., Nelson, B., Martinez-Garza, M., Slack, K., & D'Angelo, C. M. (2011). Prediction and Explanation as Design Mechanics in Conceptually-Integrated Digital Games to Help Players Articulate the Tacit Understandings they Build Through Gameplay. Poster presented as part of a structured poster session at the National Association of Research in Science Teaching 2011 meeting. Orlando, FL.
51. Clark, D. B., Nelson, B., Martinez-Garza, M., Slack, K., & D'Angelo, C. M. (2011). SURGE: Embodied Learning About Newtonian Mechanics. Paper presented as part of symposium at the National Association of Research in Science Teaching 2011 meeting. Orlando, FL.
52. Clark, D. B., Nelson, B., Martinez-Garza, M., Slack, K., & Garvey, D. (2010). Integrating Prediction Into Navigation Interfaces and Explanation Into Dialog To Help Students Articulate Tacit Understandings. Poster presented as part of a structured session at the NSF Discovery Research: K-12 2010 meeting. Washington, DC.
53. Clark, D. B., Nelson, B., Martinez-Garza, M., Slack, K., & Garvey, D. (2010). SURGE Chat & Frag. Hands-on demo and discussions as part of the Game Arcade session at the NSF Discovery Research: K-12 2010 meeting. Washington, DC.
54. Clark, D. B., Nelson, B., Martinez-Garza, M., Slack, K., & D'Angelo, C. M. (2010). SURGE: Bridging Intuitive Ideas with Disciplinary Concepts. Talk presented as part of a symposium at the NSF Discovery Research: K-12 2010 meeting. Washington, DC.
55. Clark, D. B., Nelson, B., Martinez-Garza, M., Slack, K., & D'Angelo, C. M. (2010). SURGE: Studies Completed, Underway, and In The Works. Poster presented as part of a structured session at the NSF Discovery Research: K-12 2010 meeting. Washington, DC.
56. Clark, D. B., Nelson, B., D'Angelo, C. M., Slack, K. & Martinez-Garza, M., (2010). *SURGE: Integrating Vygotsky's Spontaneous and Instructed Concepts in a Digital Game*. Poster presented at the International Conference of the Learning Sciences (ICLS) 2010 meeting. Chicago, IL.
57. Clark, D. B., Nelson, B., D'Angelo, C. M., Slack, K. & Martinez-Garza, M., (2010). *Argument Construction And Critique To Help Students Articulate Tacit Understandings, Embed Assessment, and Provide Feedback*. Presented as part of a structured poster session at the International Conference of the Learning Sciences (ICLS) 2010 meeting. Chicago, IL.

58. Clark, D. B., Nelson, B., D'Angelo, C. M., Slack, K. & Martinez-Garza, M., (2010). *SURGE: Intended and unintended science learning in games*. Presented as part of a structured poster session at the International Conference of the Learning Sciences (ICLS) 2010 meeting. Chicago, IL.
59. Martinez-Garza, M., Clark, D. B., Nelson, B., Slack, K., & D'Angelo, C. (2010, June). *Understanding students' gameplay using data-driven visualizations as an analytical approach*. Poster session presented at the International Conference of the Learning Sciences, Chicago, IL.
60. Clark, D. B., Nelson, B., D'Angelo, C. M., Slack, K. & Martinez-Garza, M., (2010). *SURGE, Vygotsky, Games: Connecting students' intuitive "spontaneous concepts" about Newtonian mechanics into formalized "instructed concepts"*. Paper presented as part of a structured poster session at the Games, Learning, and Society (GLS) 2010 meeting. Madison, WI.
61. D'Angelo, C. M., Clark, D. B., Nelson, B., Slack, K., & Menekse, M., (2010). *Student Understanding of Vector Concepts Mediated by Immersive Game Playing*. Paper presented as part of a structured poster session at the Games, Learning, and Society (GLS) 2010 meeting. Madison, WI.
62. Clark, D. B., Nelson, B., D'Angelo, C. M., Slack, K., Martinez-Garza, M., & Menekse, M. (2010). *SURGE: Assessing Students' Intuitive and Formalized Understandings About Kinematics and Newtonian Mechanics Through Immersive Game Play*. Paper presented as part of a structured poster session at the American Educational Research Association (AERA) 2010 meeting. Denver, CO.
63. Slack, K., Nelson, B., Clark, D. B., D'Angelo, C. M., & Menekse, M. (2010). *Visual Cueing and Visual Feedback to Provide Formative Assessment in a Physics-Based Video Game*. Paper presented as part of a structured poster session at the American Educational Research Association (AERA) 2010 meeting. Denver, CO.
64. Touchman, S., Clark, D. B., Menekse, M. & Skjerping, C. (2010). *Native language supports in online inquiry environments*. American Educational Research Association (AERA) 2010 meeting. Denver, Colorado.
65. Ketelhut, D., Clark, D. B., Nelson, B. C., Schifter, C., D'Angelo, C. M., Kane, T., Menekse, M., Shelton, A., Kent Slack, K., & Snyder, M. (2010). *Electrons, Photons, and Neurons: Harnessing virtual worlds to redesign science assessment*. National Association of Research in Science Teaching (NARST) 2010 meeting. Philadelphia, Pennsylvania.
66. Clark, D. B., Nelson, B. C., D'Angelo, C. M., Slack, K., Menekse, M., & Martinez-Garza, M. (2010). *SURGE: Sequencing models and representations in a physics-based video game*. National Association of Research in Science Teaching (NARST) 2010 meeting. Philadelphia, Pennsylvania.
67. Clark, D. B., Nelson, B. C., D'Angelo, C. M., Slack, K., & Menekse, M., Martinez-Garza, M. (2010). *Comparing the impact of overlaying physics-based video games with formal physics representations in Taiwan and the United States*. National Association of Research in

Science Teaching (NARST) 2010 meeting. Philadelphia, Pennsylvania.

68. D'Angelo, C. M., Clark, D. B., Nelson, B. C., Slack, K., & Menekse, M. (2010). *Connecting tacit understanding from video games to formalized vector concepts*. National Association of Research in Science Teaching (NARST) 2010 meeting. Philadelphia, Pennsylvania.
69. Slack, K., Nelson, B., Clark, D. B., Martinez-Garza, M. (2010). Influence of visual cues on learning and in-game performance in an educational physics game environment. Paper presented at the Association for Educational Communications and Technology (AECT) 2010 meeting. Anaheim, California.
70. Clark, D. B., Nelson, B., D'Angelo, C. M., Slack, K., Menekse, M., & Martinez-Garza, M. (2010). *SURGE: Articulating and Formalizing Intuitive Understandings about Newtonian Mechanics*. American Association for the Advancement of Science (AAAS) Conference 2010. San Diego, California.
71. Clark, D. B., Nelson, B., Sengupta, P., D'Angelo, C. M. (2009). Rethinking Science Learning Through Digital Games and Simulations: Genres, Examples, and Evidence. Paper commissioned for the National Research Council Workshop on Games and Simulations. Washington, D.C.
72. Clark, D. B., Nelson, B., D'Angelo, C. M., Slack, K., Martinez-Garza, M. (2009). *SURGE: Integrating Intuitive and Formal Understandings*. 2009 DR-K12 PI Meeting. Washington, DC.
73. Clark, D. B., Nelson, B., D'Angelo, C. M., Slack, K., Martinez-Garza, M (2009). *SURGE: Multiple Levels of Integrated Assessment*. Presentation as part of the organized panel *Assessing the Learning in Cyberlearning: Supporting Teachers with Technology-embedded Assessment* organized by C. Dorsey at the 2009 DR-K12 PI Meeting. Washington, DC.
74. Menekse, M., Clark, D. B., Ozdemir, G., D'Angelo, C. M., & Schleigh, S. (2009). *Turkish students' force meanings*. Paper presented at the European Science Education Research Association (ESERA) Conference 2009. Istanbul, Turkey.
75. D'Angelo, C. M., Clark, D. B., Nelson, B. C., Slack, K., & Menekse, M. (2009). *The effect of vector representations on students' understanding of motion*. Poster presented at the Physics Education Research Conference (PERC)/American Association of Physics Teachers (AAPT) 2009 meeting. Ann Arbor, Michigan.
76. Clark, D. B., D'Angelo, C. M., & Schleigh, S. (2009). *Analyzing differences and similarities in students' knowledge structure coherence and understanding of force*. Individual paper presented at the National Association of Research in Science Teaching (NARST) 2009 meeting. Garden Grove, CA.
77. Clark, D. B., Menekse, M., D'Angelo, C. M., & Schleigh, S. (2009). *Conflict schemas: Structuring online discussions to enhance learning*. Paper presented as part of an organized symposium at the National Association of Research in Science Teaching (NARST) 2009 meeting. Garden Grove, CA.

78. Clark, D. B., Nelson, B., D'Angelo, C. M., & Menekse, M., (2009). *Integrating critique to support learning about physics in video games*. Poster presented as part of a structured session at the National Association of Research in Science Teaching (NARST) 2009 meeting. Garden Grove, CA.
79. Tinker, R., Linn, M. C., & Clark, D. B., (invited/2009). *Grand challenges in technology enhanced learning in science*. Invited presentation at the National Association of Research in Science Teaching (NARST) 2009 meeting. Garden Grove, CA.
80. Touchman, S., Clark, D. B., & Skjerpig, C. (2009). *Learning science and English using native-language aids*. Individual paper presented at the National Association of Research in Science Teaching (NARST) 2009 meeting. Garden Grove, CA.
81. Clark, D. B., Sampson, V. D., Stegmann, K., Marttunen, M., Kollar, I., Janssen, J., Weinberger, A., Menekse, M., Erkens, G., & Laurinen, L. (2009). Scaffolding scientific argumentation between multiple students in online learning environments to support the development of 21st century skills. Paper commissioned for the National Research Council Workshop Exploring the Intersection of Science Education and the Development of 21st Century Skills. Washington, D.C.
82. Clark, D. B., D'Angelo, C. M., & Schleigh, S. (2009). *Comparison of students' knowledge structure coherence and understanding of force in the Philippines, Turkey, China, Mexico, and the United States*. Individual paper presented at the American Educational Research Association (AERA) 2009 meeting. San Diego.
83. Clark, D. B., Menekse, M., D'Angelo, C. M., & Schleigh, S. (2009). *Initial structuring of online discussions to improve learning and argumentation: Incorporating students own explanations as seed comments versus an augmented-presets approach to seeding discussions*. Individual paper presented at the American Educational Research Association (AERA) 2009 meeting. San Diego.
84. Clark, D. B., Touchman, S., & Skjerpig, C. (2009). *Increasing access for English language learners in online learning environments: Integrating Spanish and English audio and text language supports to support science learning*. Individual paper presented at the American Educational Research Association (AERA) 2009 meeting. San Diego.
85. Clark, D. B., Nelson, B., D'Angelo, C. M., Menekse, M., & Slack, K. (2008). *Scaffolding understanding through research on Games for Education (SURGE)*. Poster presented at the 2008 DR-K12 PI Meeting. Washington, DC.
86. Clark, D. B., D'Angelo, C. M., & Schleigh, S. (2008). *International comparison of knowledge structure coherence: Cultural, semantic, and educational differences*. Individual paper presented at the International Conference of the Learning Sciences (ICLS) 2008. Utrecht, Netherlands.
87. Clark, D. B., Menekse, M., D'Angelo, C. M., Touchman, S., & Schleigh, S. (2008). *Scaffolding students' argumentation about simulations*. Paper presented as part of a symposium organized by Hsin-Yi Chang to the International Conference of the Learning

Sciences (ICLS) 2008. Utrecht, Netherlands.

88. Schleigh, S., Clark, D. B., D'Angelo, C. (2008). *The impact of gender on conceptual theoretical framework and cognition across cultures*. Individual paper presented at the National Association of Research in Science Teaching (NARST) 2008 meeting. Baltimore, MD.
89. Clark, D. B., Schleigh, S., D'Angelo, C. M., Ozdemir, G., Menekse, M., Zhang, Z., & Corpuz, E. (2008). *Cross-cultural analysis of knowledge structure coherence and understanding of force*. Individual paper presented at the National Association of Research in Science Teaching (NARST) 2008 meeting. Baltimore, MD.
90. Sampson, V. & Clark, D. B. (2008). *Differences in the ways more and less successful groups engage in argumentation: A case study*. Individual paper presented at the National Association of Research in Science Teaching (NARST) 2008 meeting. Baltimore, MD.
91. Clark, D. B., Schleigh, S. P., Menekse, M., D'Angelo, C. M., & Sampson, S. (2008). *Improving the quality of student argumentation through the initial structuring of online discussions*. Paper presented as part of symposium organized by William Sandoval for the American Educational Research Association (AERA) 2008 meeting. New York.
92. Clark, D. B., D'Angelo, C. M., Schleigh, S., Ozdemir, G., Menekse, M., Zhang, Z., & Corpuz, E. (2008). *International analysis of students' knowledge structure coherence*. Individual paper presented at the American Educational Research Association (AERA) 2008 meeting. New York.
93. Clark, D. B., D'Angelo, C. M., & Schleigh, S. (2008). *International analysis of students' knowledge structure coherence: Poster overview of research findings*. Participant in the NAEd-Spencer/IES/AERA postdoctoral fellowship poster session at the American Educational Research Association (AERA) 2008 meeting. New York.
94. Sampson, V. & Clark, D. B. (2008). *The effects of collaboration on argument quality and learning*. Individual paper presented at the American Educational Research Association (AERA) 2008 meeting. New York.
95. Schleigh, S., & Clark, D. B. (2008). *The modeling curriculum and measurement in conceptual theoretical frameworks for force concepts in a classroom*. Individual paper presented at the American Educational Research Association (AERA) 2008 meeting. New York.
96. Clark, D. B., D'Angelo, C. M., & Schleigh, S. (2007). *International analysis of students' knowledge structure coherence: Progress to date*. Paper presented at the National Academy of Education/Spencer Foundation 2007 Annual Meeting. Washington, DC.
97. Clark, D. B., (2007, July). *Analytic frameworks that focus on conceptual quality in CSCL environments*. Paper presented at the Computer Supported Collaborative Learning (CSCL) Conference 2007. Rutgers, New Jersey.

98. Clark, D. B., & Sampson, V. (2007, July). *Fostering productive argumentation in online environments: Strategies for grouping students in discussion forums*. Paper presented at the Computer Supported Collaborative Learning (CSCL) Conference 2007. Rutgers, New Jersey.
99. Clark, D. B., Menekse, M., Seetharaman, R., & Sampson, V. (2007). *Scaffolding students' debates about the implications of simulations*. Structured poster presentation at the American Educational Research Association (AERA) 2007 meeting in Chicago, Illinois.
100. Clark, D., Atkinson, R., Touchman, S., Skjerpings, T., Ramirez, F., Harrison, C., & Koenig, A. (2007). *The impact of providing Spanish audio and text supports in online learning environments for Spanish speaking English language learners*. Structured poster presentation at the American Educational Research Association (AERA) 2007 meeting in Chicago, Illinois.
101. Atkinson, R., Clark, D., Harrison, C., Koenig, A., & Ramirez, F. (2007). *Multimedia learning environments: Do the redundancy and modality principles apply to English language learners?* Presented at the American Educational Research Association (AERA) 2007 meeting in Chicago, Illinois.
102. Clark, D. B. (August, 2006). *Frameworks for assessing argument in science education*. Invited keynote presented at the International Workshop of Argumentation in Science Teaching and Learning. Kaoshiung, Taiwan.
103. Clark, D. B. (July, 2006). *Scaffolding argumentation in online science learning environments: The TELS Project*. Invited keynote presented at the International Workshop of Argumentation in Science Teaching and Learning. Taipei, Taiwan.
104. Sampson, V. & Clark, D. B. (2006, July). *Assessment of argument in science education: A critical review of the literature*. Paper presented at the International Conference of the Learning Sciences Conference 2006. Bloomington, Indiana.
105. Clark, D. B., & Sampson, V. (2006, July). *Evaluating argumentation in science: New assessment tools*. Paper presented at the International Conference of the Learning Sciences 2006. Bloomington, Indiana.
106. Sampson, V. & Clark, D. B. (2006, April). *The development and validation of the Nature of Science as Argument Questionnaire (NSAAQ)*. Paper presented at the National Association of Research in Science Teaching Conference 2006. San Francisco, California.
107. Lemanowski, V., Yasar, S., Reynolds, S., & Clark, D. (2006, April). *The evolution of a test item: Using item analysis to build a better geology test*. Paper presented at the National Association of Research in Science Teaching Conference 2006. San Francisco, California.
108. Clark, D. B., & Sampson, V. (2006, April). *Promoting high quality dialogical argumentation in online environments: Optimizing scaffolding for students' initial comments*. Paper presented American Educational Research Association (AERA), San Francisco, California.

109. Clark, D. B., & Sampson, V. (2006, April). *Characteristics of students' argumentation practices when supported by online personally-seeded discussions*. Paper presented at the annual meeting of the National Association of Research in Science Teaching, San Francisco, California.
110. Sampson, V & Clark, D. B. (2005, November). *Examining the connection between students' epistemological commitments and scientific argumentation using the NSAAQ*. Paper presented at the Inaugural Conference of the Southwest Consortium for Innovations in Psychology in Education (SCIPIE). Las Vegas, Nevada.
111. Clark, D. B., & Sampson, V. (2005, June). *Analyzing the quality of argumentation supported by personally-seeded discussions*. Paper presented at the annual meeting of the Computer Supported Collaborative Learning (CSCL) Conference, Taipei, Taiwan.
112. Clark, D. B. (2005, April). *Conceptual change in thermodynamics: Theories or pieces?* Paper presented at the annual meeting of the American Educational Research Association (AERA), Montreal, Canada.
113. Clark, D. B., Sampson, V., & Lemanowski, V. (2005, April). *Technology Opening Diverse Opportunities for Science (TODOS): Discourse participation*. Paper presented at the annual meeting of the American Educational Research Association (AERA), Montreal, Canada.
114. Lemanowski, V., Clark, D. B., & McLean-Flynn, K. (2005, March). *What about the wolves? Fourth graders argumentation and ecological management planning in an on-line environment*. Paper presented at the annual meeting of the National Association of Research in Science Teaching, Dallas, Texas.
115. Clark, D. B., & Sampson, V (2005, March). *The conceptual quality of student argumentation in online discussions*. Paper presented at the annual meeting of the National Association of Research in Science Teaching, Dallas, Texas.
116. Farnsworth, K., Llama, G., Lemanowski, V., Na, Y. & Clark, D. B. (2004, October). *Developing online problem-based instruction for bilingual learners: Technology Opening Diverse Opportunities for Science (TODOS)*. Presentation at the annual meeting of the Association for Educational Communications and Technology, Chicago, Illinois.
117. Farnsworth, K., Llama, G., Lemanowski, V., Na, Y. & Clark, D. B. (2004, November). *E-learning for language learning: online problem-based units to support language acquisition*. Presentation at the annual meeting of the American Council of Teachers of Foreign Language, Chicago, Illinois.
118. Clark, D. B. (2004, June). *Personally-seeded discussions to scaffold argumentation online*. Poster presented at the annual meeting of the International Conference of the Learning Sciences (ICLS), Santa Monica, California.
119. Drazinski, D., & Clark, D. B., (2004, June). *Supporting science learning in online environments*. Presentation at the Arizona Science Teachers Association (ASTA), Mesa,

Arizona.

120. Clark, D. B. (2004, April). *Supporting argumentation in online inquiry*. Paper presented at the annual meeting of the American Educational Research Association (AERA), San Diego, California.
121. Clark, D. B., Reynolds, S., Lemanowski, V., Corkins, V., Stiles, T., Stromfors, C., Yasar, S., Joshua, M., Proctor, S., and Brown, M. (2004, March). *Strategies and assumptions university students use to interpret topographic maps*. Paper presented at the annual meeting of the National Association of Research in Science Teaching, Vancouver, Canada.
122. Clark, D. B. & Linn, M. C. (2003, April). *Designing for knowledge integration: The role of instructional time in curricular depth*. Paper presented at the annual meeting of the American Educational Research Association (AERA), Chicago, Illinois.
123. Clark, D. B., Weinberger, A., Jucks, R., Spitulnik, M., and Wallace, R. (2003, April). *Designing effective science inquiry in text-based computer supported collaborative learning environments*. Structured poster presentation presented at the annual meeting of the American Educational Research Association (AERA), Chicago, Illinois.
124. Clark, D. B. (2003, March). *Analyzing student knowledge integration: Theories or pieces?* Paper discussion presented at the annual meeting of the National Association of Research in Science Teaching, Philadelphia, Pennsylvania.
125. Clark, D. B. (2003, January). *Harnessing online learning environments to support English Language Learners*. Presentation at annual meeting of Language and Literacy, Tempe, Arizona.
126. Clark, D. B. (2002, October). *Harnessing learning environments to support English Language Learners: Engaging students in the discourse of science and academic language synergistically*. Poster presented at the International Conference of the Learning Sciences, Seattle, Washington.
127. Clark, D. B. (2002, April). *A WISE foundation: Researching the impact of inquiry and technology on students' understandings of science*. Paper presented at the annual meeting of the National Association of Research in Science Teaching, New Orleans, Louisiana.
128. Clark, D. B., & Linn, M. C. (2002, April). *The role of instructional time in curricular depth: Knowledge integration in the CLP curriculum*. Paper discussion presented at the annual meeting of the American Educational Research Association (AERA), New Orleans, Louisiana.
129. Slotta, J. D., Clark, D. B., & Cheng, B. (2002, January). *Integrating Palm hand-held technology into the Web-based Inquiry Science Environment (WISE)*. Paper presented at the annual meeting of Computer Supported Collaborative Learning, Boulder, Colorado.
130. Clark, D. B. (2001, April). *New representations of student knowledge integration in CLP: Theories or repertoires of ideas?* Paper presented at the American Educational Research

Association (AERA), Seattle, Washington.

131. Clark, D. B., & Jorde, D. (2000, April). *Scaffolding knowledge integration through re-explanation & pivotal cases*. Paper presented at annual meeting of the National Association of Research in Science Teaching, New Orleans, Louisiana.
132. Cuthbert, A. J., Clark, D. B., Slotta, J. D., & Jorde, D. (2000, April). *Helping elicit self-explanation & clarification through personalized electronic discussions*. Poster presented at the American Educational Research Association (AERA), New Orleans, Louisiana.
133. Clark, D. B., & Jorde, D. (1999, December). *Knowledge integration and the scaffolding role of collaboration within an electronic laboratory/discussion project*. Poster presented at CSCL 99, Stanford, California.
134. Clark, D. B. & Linn, M. C. (1999, May). *Simulations as bridging scaffolds for intuitive conceptions*. Poster presented at the annual conference sponsored by the Center for Innovation in Learning Technologies, San Jose, California.
135. Clark, D. B. (1999, April). *Mapping knowledge integration in conceptual change*. Paper presented at the American Educational Research Association (AERA), Montreal, Canada.
136. Clark, D. B. (1999, April). *Longitudinal study of the impact of depth of coverage on student knowledge integration*. Paper presented at the American Educational Research Association (AERA), Montreal, Canada.
137. Clark, D. B. (1997, March). *The factors and criteria that teachers consider in evaluating technology: The practicality ethic and the scaffolded knowledge integration framework in teacher decision making*. Paper presented at the American Educational Research Association (AERA), Chicago, Illinois.
138. Clark, D. B. (1997, March). *The role of source credibility and media format in student interpretation of internet resources: Sex, lies, and multimedia*. Paper presented at the American Educational Research Association (AERA), Chicago, Illinois.

Research Grants (Funded)

1. *Extending CTSiM: An Adaptive Computational Thinking Environment for Learning Science through Modeling and Simulation in Middle School Classrooms*
National Science Foundation: Cyberlearning, \$1,347,359
Funded: 2014-2017

Gautam Biswas (PI), Pratim Sengupta (CoPI), Douglas Clark (CoPI), John Kinnebrew (CoPI). This proposal extends our successful EXP project, where we developed CTSiM (Computational Thinking using Simulation and Modeling). CTSiM employs a computational thinking (CT) approach to model design, implementation, matching, and verification in multiple science domains, e.g., ecology and kinematics. This new DIP proposal will

systematically study the challenges that students face in a CT approach to building, reasoning, and problem solving with formal science models and develop an adaptive scaffolding framework to support students in these activities. We will develop a systematic approach that combines off-line data-driven analysis to find behavior patterns and model-driven analysis based on a cognitive/metacognitive task model with model-driven assessments for interpreting and evaluating students' learning activities and proficiencies in their learning and problem solving tasks. Triggered by students' erroneous and suboptimal behaviors, adaptive scaffolds will provide practice and guided support on relevant cognitive and metacognitive processes. These scaffolds will incorporate argumentation discourse combining causal modeling and experimentation to help students develop the skills to critique, explain and argue to support their models.

2. Enhancing Games with Assessment and Metacognitive Emphases (EGAME).
National Science Foundation DRK12, \$3,149,239
Funded: 2011-2016

Douglas Clark (PI), Gautam Biswas (CoPI), James Minstrell (CoPI), Pratim Sengupta (CoPI). EGAME will create a game-based learning environment to scaffold and diagnostically assess middle school student's understanding of Newtonian mechanics. EGAME focuses on two core questions. Can research on metacognition, conceptual change, and students' explanations inform the design of dialog systems in digital games to foster science learning and engagement? Can research on computer-adaptive testing and hidden Markov modeling support real-time diagnostic modeling of students' understanding by analyzing their explanations in the dialog? The EGAME team combines researchers, teachers, and professional game developers to effectively integrate cutting-edge research, deep practical experience in schools, and top-level game design and production values. The core team includes Douglas Clark, Gautam Biswas, and Pratim Sengupta of Vanderbilt University, Jim Minstrell of Facet Innovations, and Dan White of Filament Games. Other senior personnel include Ric Luecht, Dan Norton, and Patty Littlejohn. Advisors will be Jim Gee, Micki Chi, Steve Reise, James Lester, Sarah Baker, Val Shute, Dan Schwartz, David Hammer, Andrew Heckler, Katherine Perkins, and Noah Podolefsky. EGAME will develop, pilot, and validate approaches to: (a) scaffold students' explicit articulation of connections between intuitive understandings and disciplinary concepts and (b) provide real-time modeling of players' evolving understanding to support adaptive scaffolding and provide formative and summative diagnostic information to teachers and researchers.

3. Explanation and Prediction Increasing Gains and Metacognition (EPIGAME).
Department of Education IES, \$1,305,331
Funded: 2011-2015

Douglas Clark (PI) and Dan White (CoPI). This proposal integrates metacognitive research on prediction and explanation into the design of a physics-based digital game environment to scaffold students' understanding of formal physics concepts. The design of the EPIGAME environment will support pilot and future research on games for learning through (a) randomized assignment of players to multiple configurations of parameters within the game and (b) embedded computer-adaptive assessment and data log analysis functionality to

support sophisticated analytics and data collection. We will identify the most effective combinations of prediction and explanation functionalities, along with other game features, to include in freely available release versions of the game. Our ultimate goal is for teachers to use EPIGAME software to scaffold middle school students (and potentially older students) in bridging intuitive understandings with explicit articulated core concepts of Newtonian mechanics.

4. Fostering Computational Thinking in Middle Schools through Scientific Modeling & Simulation (CTSim). National Science Foundation Cyberlearning, \$550,000
Funded: 2011-2013

Gautam Biswas (PI), Pratim Sengupta (CoPI), Douglas Clark (CoPI). Computational thinking draws on concepts that are fundamental to computing and computer science, however, as an approach, it includes concepts, such as problem representation, abstraction, decomposition, reformulation, simulation, verification, reasoning, and prediction, that apply to modeling, reasoning, and problem solving in a large number of disciplines (NRC, 2010). Consequently, computational thinking can be closely related modeling, reasoning, and problem solving tasks in STEM disciplines, drawing upon its synergy with scientific thinking and analysis, as well as engineering design and evaluation. Our overall goals are to adopt and build on the primary ideas of computational thinking and design technology-based learning environments that support learning of science, mathematics, and computing in an integrated fashion in middle school classroom environments.

5. Supplement: Technology-Enhance Learning in Science (TELS)
NSF Center for Learning and Teaching, \$100,000 for ASU/\$1,000,000 overall
Funded: 2009-2010

I was part of a group that submitted and won an NSF Center for Learning and Teaching grant (see below). I was a project director for the grant as a whole and was the PI for the ASU subcontract of the grant. We successfully applied for a supplement to extend that grant for two years with an additional \$100,000 coming to ASU.

6. Scaffolding Understanding by Redesigning Games for Education (SURGE)
National Science Foundation, \$450,000
Funded: 2008-2012

Douglas Clark (PI) and Brian Nelson (CoPI). SURGE developed and assessed design principles, and learning environments instantiating these principles, that integrate research on conceptual change, cognitive processing-based design, and socio-cognitive scripting into the design of popular commercial video games to support students' understanding of Newtonian mechanics. The goals of SURGE focused (1) on increasing eighth grade students' understanding of Newtonian mechanics including core elements from high school curricula (2) while retaining the strong motivational components of current commercial game design, and (3) and helping close achievement, motivation, and self-efficacy gaps among female students, English language learners, and students with low prior success in science.

7. International Analysis of Students' Knowledge Structure Coherence
National Academy of Education-Spencer Postdoctoral Fellowship, \$55,000
Funded: 2006-2008

The *NAEd/Spencer Post-Doctoral Fellowship* is considered by many people in education to be the most prestigious early career award for the field. My NAEd/Spencer postdoctoral fellowship investigated students' understanding of the scientific concept of "force" in Turkey, China, Korea, Mexico, and the United States. The study contributed to the resolution of a central controversy among researchers of conceptual change regarding the structure and coherence of students' science knowledge. This study additionally clarified the role of methodological and semantic/cultural differences in the findings of researchers on opposing sides of the controversy.

8. *Project Pathways: Opening Routes to Math & Science Success for all Students*
NSF Targeted Mathematics and Science Partnership, \$12,323,993
Funded: 2004-2009

A team on which I participated won an NSF Mathematics and Science Partnership (MSP) grant for \$12,323,993. The grant is a university-wide collaboration. I wrote the English language learner section of the proposal, I was not a PI on the grant, but I was on the leadership team for the grant once it was funded, and I co-led the English-language learner team, which had an internal budget of approximately \$1,000,000. The ELL team researched models for coordinating multiple representations, animated agents, and multiple languages to support ELL students.

9. Technology-Enhance Learning in Science (TELS)
NSF Center for Learning and Teaching, \$514,000 for ASU/\$10,000,000 overall
Funded: 2003-2008

I was part of a group that submitted and won an NSF Center for Learning and Teaching. The Center included twelve institutions led by UC Berkeley. I was a project director for the grant as a whole and was the PI for the ASU subcontract of the grant. The budget for the full grant is \$10,000,000 and the ASU budget is \$514,000 over the five years of the grant.

10. Technology Opening Diverse Opportunities for Science (TODOS)
ASU College of Education, \$30,000
Funded: 2003-2004

I organized and led the TODOS group to submit and win a College of Education internal grant competition. I was the PI on this grant with Eugene Garcia, Jeff MacSwan, and Wilhelmina Savenye as the Co-PIs. The research focused on supporting science and language learning by giving students metalinguistic choices in terms of the language of content and support and allowing them to shift back and forth as they studied science in an online learning environment.

Teaching, Advising, and Mentoring Activities

a. *Vanderbilt Courses Taught*

EDUC 7180/7500: Design of Learning Environments with a Focus on Play
SCED 6100: Investigations and Trends in Science Education
EDUC 3900: Learning Sciences and Learning Environment Design
EDUC 3900: Teacher Learning and Professional Development
SCED 3900: Math and Science / Science Inquiry and Technology (TLUS)
SCED 3900: Digital Games and Learning
EDUC 3900: Seminal Readings in Science Education
SCED 3900: Inquiry and Technology
EDUC 3120: Learning and Instruction
EDUC 3700: Research Group on Games and Learning
SCED 2292/3007 Student Teaching Semester Science Ed Seminar
SCED 2370/3370: Teaching Science in Secondary Schools

b. *Chair/Mentor for Faculty*

Chair of Heather Johnson's Mentor Committee (2011-present)

Chair of Pratim Sengupta's Mentor Committee (2009-2015)

c. *Chair/Advisor for Doctoral Students (In Progress)*

Vanderbilt. Grant van Eaton (Ph.D.), Jenna Peet (Ph.D.), Ashlyn Karan (Ph.D.)

d. *Chair/Advisor for Doctoral Students (Ph.D. Completed)*

Mario Martinez-Garza (Ph.D. 2016)

Martinez-Garza, M. (2016). Coevolution of Theory and Data Analytics of Digital Game-Based Learning. Unpublished Doctoral Dissertation. Vanderbilt University.

Post-Doctorate position at University of California at Berkeley.

Cynthia D'Angelo (Ph.D. 2010) (Chair and then Co-Chair upon coming to Vanderbilt)

D'Angelo, C.M. (2010). Scaffolding vector representations for student learning inside a physics game. Unpublished doctoral dissertation. Arizona State University.

Post-Doctorate position at University of Wisconsin at Madison and currently a

research scientist at SRI.

Victor Sampson (Ph.D. 2007)

Sampson, V. D. (2007). The effects of collaboration on argumentation outcomes. Unpublished doctoral dissertation. Arizona State University.

Victor Sampson won the **Outstanding Dissertation Award from the National Association for Research on Science Teaching**, 2008.

Associate professor at Florida State University (Offered positions at University of Georgia and University of North Carolina at Chapel Hill)

Gokhan Ozdemir (Ph.D. 2006)

Ozdemir, G. (2006). The role of contextual sensitivity in the conceptualization of force. Unpublished doctoral dissertation. Arizona State University.

Associate professor at Nigde University in Turkey

e. Chair/Advisor for Doctoral Students (Ed.D. Completed)

Tina Skjerping (Ed.D. 2009)

Skjerping, T. (2009). Application of the Instructional Congruence Framework: Developing supplemental materials for English language learners. Unpublished doctoral dissertation. Arizona State University.

Analyst for Sustainability Initiatives, Salt River Project (Arizona Electrical Utility)

James Corkins (Ed.D. 2009)

Corkins, J. (2009). The psychometric refinement of the Materials Concept Inventory (MCI). Unpublished doctoral dissertation. Arizona State University.

Lecturer at Arizona State University

Sharon Schleigh (Ed.D. 2008)

Schleigh, S. (2008). Format and sex in assessing the knowledge structure coherence of middle school student' understanding of the concept of force. Unpublished doctoral dissertation. Arizona State University.

Assistant Professor at East Carolina University (Also offered position at Towson University)

f. Doctoral Dissertations Supported By Software Developed On Grants

Barnes, Jacqueline (2015). Investigating the diversity of users' experiences within an educational game. Dissertation. University of Indiana: Bloomington, IN.

Stewart, Phillip, (2013). Learning the rules of the game: The nature of game and classroom supports when using a concept-integrated digital physics game in the middle school science classroom. Columbia University: New York, NY.

g. Doctoral Dissertation Committees Served On (In Progress)

Vanderbilt University. Kara Krinks, Amanda Dickes, Satabdi Basu

h. Doctoral Dissertation Committees Served On (Completed)

Vanderbilt University. James Segedy (Computer Science, 2014), Eve Manz (2013)

University of Wisconsin at Madison. Esra Algoz (2011)

University of Toronto (Ontario Institute for Studies in Education). Vanessa Peters (2010)

Arizona State University. Eun Jin Bang, Asmaa Shbeer, Cumali Oksuz, Qi Dunsworth, Charlotte Stromfors, Sian Proctor, Thomas Stiles, Senay Yasar, Sibel Uysal, Jamie Jensen, Ji Sook Han, Jennifer Neakrase

i. Chair/Advisor for Masters Projects (In Progress)

Vanderbilt: Dan Cooper

j. Chair/Advisor for Masters Students (Completed)

Vanderbilt: Eric Tan (2015), Jenna Peet (2015), Shara Bellamy (2013), Jamie Eldredge (2013), James Hughes (2013), Courtney Luckabaugh (2011)

Arizona State University. Maiya Delgoda, Tony Pacilli, Steu Mann, Eva Vaz, Tiffany Hansen, Jennifer Might, Sandra Hagan, Dan Fortney, Ashley Kerstetter, Jennefer Malyka, Paul Scamperle, Michelle Fong, Grant Paris, Chris Lemke, Fatimah Alhashem, Carrie Repp

Service to the Profession, the University, and the Community

Professional Participation

a. Leadership Activities

1. *Survey Assessment Innovations Lab Network* advisor to the *National Assessment of Educational Progress* (NAEP). NAEP SAIL is a hothouse dedicated to explorations in the cognitive sciences, assessment, and technology that will enable a continuously updated NAEP assessment. (2013-present)
2. Member of *Learning Games Playdata Consortium*. Consortium focuses on datamining approaches for research on games for learning. Consortium led by Games, Learning, and Society Center. (2013-present)
3. Member of the *Academic Consortium on Games for Impact*. Consortium initially commissioned by the *White House Office of Science and Technology Policy* (OSTP) in 2012 and continuing independently since then. (2012- present)
4. Chair-Elect/Chair for the American Educational Research Association's Special Interest Group (SIG) for Advanced Technologies for Learning, 2003-2005.
5. Mentorship through organizations:
 - a. Mentor for Division C doctoral consortium prior to the American Educational Research Association (AERA, 2014, Philadelphia, PA)
 - b. Mentor at early career consortium prior to the American Educational Research Association (AERA, 2012, Vancouver, Canada)
 - c. Mentor at early career consortium prior to the International Conference of the Learning Sciences (ICLS 2010, Chicago, Illinois)
 - d. Mentor at doctoral consortium prior to the International Conference of the Learning Sciences (ICLS 2002, Seattle, Washington)

b. Editorial Boards

1. Editorial Board Member for *Science Education* (2011-present)
2. Editorial Board Member for *Journal of the Learning Sciences* (2010-present)
3. Editorial Board Member for the *Journal of Research in Science Teaching* (2004-2007, 2010-2014)
4. Editorial Board Member for *International Review of Contemporary Learning Research* (2012-present)
5. Editorial Board Member for *International Journal of Gaming and Computer-Mediated Simulations* (2014-present)

c. Journal Reviewer

1. Reviewer for the *Journal of the Learning Sciences* (2005-present)
2. Reviewer for *Journal of Research in Science Teaching* (2002-2004)

3. Reviewer for Science Education (2004-present)
4. Reviewer for Educational Psychologist (2010-present)
5. Reviewer for Cognition and Instruction (2006-present)
6. Reviewer for Science and Education (2007-present)
7. Reviewer for Journal of Science Education and Technology (2008-present)
8. Reviewer for Computers and Education (2010-present)
9. Special Reviewer for Bilingual Research Journal (2004-2006)
10. Special Reviewer for International Journal of Science Education (2005-2007, 2012-present)
11. Special Reviewer for Learning and Individual Differences (2008)
12. Special Reviewer for Instructional Science (2011-present)
13. Special Reviewer for Interacting with Computers (2012-present)
14. Special Reviewer for Information Sciences (2012-present)

Conference Participation

a. Conference Reviewer

I regularly review for the following conferences:

1. American Educational Research Association
2. International Conference of the Learning Sciences
3. Computer Supported Collaborative Learning
4. National Association of Research in Science Teaching
5. Games, Learning, and Society

b. Conference Participation and Planning

Conference Planning

1. Program Committee for International Conference on Computers in Education (ICCE) 2013 theme section Digital Game and Digital Toy Enhanced Learning and Society.
2. Executive Planning Committee for Games, Learning, and Society 2011 conference

3. Executive Planning Committee for Games, Learning, and Society 2010 conference

Session Organizer

1. Clark, D. B. (2013). *Connecting and Assessing Informal and Formal Understanding in Digital Games and Virtual Worlds*. Symposium presented at the National Association of Research in Science Teaching (NARST) 2013 meeting. Rio Grande, Puerto Rico.
2. Clark, D. B. (2012). *Synergistically Leveraging Popular Game Mechanics with Research on Learning and Assessment*. Symposium at Discovery Research K-12 (DR-K12) 2012 meeting. Arlington, VA.
3. Clark, D. B. (2013). *Digital Games and Conceptual Change in Core Concepts*. Symposium presented at the National Association of Research in Science Teaching (NARST) 2011 meeting. Orlando, Florida
4. Clark, D. B. (2010). *Terra Nova Toward Terra Firma: Data on Games for Science Learning*. Organizer for structured poster session. International Conference of the Learning Sciences (ICLS) 2010 meeting. Chicago, Illinois.
5. Clark, D.B. (2010). *Electrons, Photons, and Neurons: Data on Learning Science Concepts, Skills, and Processes in Video Games and Virtual Worlds*. Organizer of structured poster session. Games, Learning, and Society (GLS) 2010 meeting. Madison, WI.
6. Clark, D. B., & Nelson, B. C. (2010). *Games Research 2.0: Assessing learning in and around educational games and virtual worlds*. Organizers for structured poster session. American Educational Research Association (AERA) 2010 meeting. Denver, Colorado.
7. Kafai, Y, & Clark, D. B. (2010). *Worlds of wonder: Can video games teach science?* Symposium organizers for session including papers by Yasmin Kafai, Michelle Roper Fox, Paul Horwitz, Diane Ketelhut, Nina Fefferman, and Eric Klopfer. Marcia Linn and Robert Tinker as discussants. American Association for the Advancement of Science (AAAS) Conference 2010. San Diego, California.
8. Clark, D. B., & Sampson, V. (2007, July). *Evaluating the quality of dialogical argumentation in CSCL: Moving beyond an analysis of formal structure*. Symposium organizers and chairs for session including papers by Gijsbert Erkens, Armin Weinberger, Douglas Clark, and Victor Sampson. Computer Supported Collaborative Learning (CSCL) Conference 2007. Rutgers, New Jersey.
4. Clark, D. B., & Sampson, V. (2006, April). Using computers and online environments to support argumentation. Symposium organizers and chairs for session including papers by Frank Fischer, Armin Weinberger, & Karsten Stegmann; Douglas Clark & Victor Sampson; William Sandoval & Kelli A. Millwood; and Gregory Kelly & William Prothero. Marlene Scardamalia as discussant. American Educational

Research Association, San Francisco, California.

5. Clark, D. B., & Sampson, V. (2006, April). International perspectives on argumentation research in science education: Achievements, current boundaries, and next steps. Symposium organizers and chairs for session including papers by Philip Bell & Leah A. Bricker; Sibel Erduran, Dilek Ardac, & Buket Yakmaci Guzel; Douglas Clark & Victor Sampson; and Fins Eirexas, Maria Pilar Jiménez Aleixandre, & Marta F. Agraso. Jonathan Osborne as discussant. National Association of Research in Science Teaching, San Francisco, California.
6. Clark, D. B. & Gobert, J. (2006, April). Critical issues for modeling-based instruction in online environments. Symposium organizers and chairs for session including papers by Janet M. Casperson & Jennifer L. Chiu; Kevin McElhaney; Douglas Clark, Robert Atkinson, Jeff Holmes, Ji-Sook Han, Alan Koenig, and Alexander Kim, Vivian Lemanowski; and Erika D. Tate & Jason R. Finley. Janice Gobert as discussant. Presented at the annual meeting of the National Association of Research in Science Teaching, San Francisco, California.
7. Clark, D. B. (2003, April). *Learning through online collaborative discourse: A German US collaboration on theory, design, and analysis*. Session organizer for this structured poster session presented at the annual meeting of the American Educational Research Association, Chicago, Illinois.
8. Clark, D. B., & Foley, B. (1999, April). *Surveying the conceptual landscape: New views of conceptual change in science*. Symposium organizer for session including papers by Andrea diSessa, Douglas Clark, John Clement, Mary Anne Rea-Ramirez, and Brian Foley with Kenneth Strike acting as discussant. American Educational Research Association, Montreal, Canada.
9. Clark, D. B. (1999, April). *Depth of coverage: What progress have we made toward achieving it, what are the obstacles, and what benefits can we expect?* Symposium organizer for session including papers by William Schmidt, Douglas Clark, Marcia C. Linn, and Angelo Collins with Fred Newmann acting as discussant. American Educational Research Association, Montreal, Canada.

Session Discussant or Chair

1. Clark, D. B. (2015). Dealing with Game Data. Discussant for this session at Games, Learning, and Society 2015. Madison, WI.
2. Clark, D. B. (2015). Learning Sciences: STEM Learning With and Through Technological Tools. Discussant for this session at the American Educational Research Association (AERA) 2015 meeting. Chicago, IL.
3. Clark, D. B. (2015). New Perspectives for Serious Gaming: Games That Integrate Making and Playing for Learning. Discussant for this session at the American Educational Research Association (AERA) 2015 meeting. Chicago, IL.

4. Clark, D. B. (2014). When Friends Argue: Investigating Argumentative Learning Processes in Facebook. Discussant for this session at the annual meeting of the International Conference of the Learning Sciences, Boulder, Colorado.
5. Clark, D. B. (2014). Of Bodies and Minds: Immersive Physical Sensor Technologies and STEM Learning. Discussant for this session at the annual meeting of the American Educational Research Association, Philadelphia, Pennsylvania.
6. Clark, D. B. (2012). *Argument Evaluation in Education*. Discussant for this session at the annual meeting of the American Educational Research Association, Vancouver, Canada.
7. Clark, D. B. (2006, April) Teaching strategies for scaffolding model-based learning in science. Chair/Discussant for session organized by Grant Williams and John Clement at the National Association of Research in Science Teaching Conference 2006. San Francisco, California.
8. Clark, D. B. (2004, June). *Multi-User Online Environments*. Chaired this session at the annual meeting of the International Conference of the Learning Sciences, Santa Monica, California.
9. Clark, D. B. (2003, April). *New technologies for communication and communities of science learners*. Discussant for this session at the annual meeting of the American Educational Research Association, Chicago, Illinois.
10. Clark, D. B. (2000, April). *Learning science through authentic inquiries: Impacts on teachers and students*. Chaired session at annual meeting of the National Association of Research in Science Teaching, New Orleans, Louisiana.
11. Clark, D. B. (1996, August). *The Internet and the classroom*. Panel discussant at the NASA Minority University Conference at the University of Texas, El Paso, Texas.

Vanderbilt University Service

a. University

- Advisory Board to VIDL (Vanderbilt Institute for Digital Learning) (September 2015-present).
- University Technology Review Committee (August 2015-May 2018)
- Vice Chancellor's IT Transitions Faculty Advisory Committee (December 2014-present)
- Faculty Advisor to Vanderbilt Gamecraft student organization dedicated to game design by undergraduate students. (2014-present)
- Faculty Senate Online Education Task Force (2013-2015)

- Faculty Senate, Peabody Representative (2011-2014)
- Vanderbilt University Dissertation Enhancement Grant proposal reviewer (Spring 2014).
- Academic Policies and Services Committee Member on Faculty Senate (2011-2013)
- Provost's Online Education Task Force (August-October 2012; January-May 2013)
- Vanderbilt Honor Fellowships Review Committee (Spring 2013)
- Vanderbilt International Office VIO Research Grants review committee (Fall 2011, Spring 2012, Fall 2012, Spring 2013, Fall 2013)
- Center for Teaching, Peabody Representative serving on Center for Teaching Advisory Board (December 2010-2013)

b. College

- Serve on ExpERT steering committee (2012-present).
- Served on the Educational Neuroscience Faculty Position Search (2011-2012).
- Participated in series of meetings with Lee Limbird and other Peabody/Fisk faculty and administrators exploring possible approaches to support credentialing of science students and faculty. (2010)

c. Department

- Chair Learning Sciences and Learning Environment Design Faculty Position Search (2015-2016)
- Area Chair of Learning Sciences and Learning Environment Design doctoral specialization (2015-present).
- Co-Chair for Digital Literacies Faculty Position Search (2014-2015)
- Co-Chair for Digital Literacies Faculty Position Search (2013-2014)
- Co-Chair for Digital Literacies Faculty Position Search (2012-2013)
- Area Chair of Learning Sciences and Learning Environment Design doctoral specialization (2010-2013).
- Served on Diversity and Urban Education Faculty Position Search (Spring 2011).
- Led planning, design, and approval of the Learning Sciences and Learning Environment Design specialization in our doctoral program with Pratim Sengupta (2010)
- Secondary Science point person for the NCATE review (2009-2010)
- Science point person for planning of the Master's in Teaching and Learning in Urban Schools for MNPS Teachers (2009-2010)
- Reviewed Master's capstone proposals (2010)

- Chaired Science Practice Faculty Position Search (2010)

Community Outreach

1. As mentioned under leadership activities, I am a *Survey Assessment Innovations Lab Network* advisor to the *National Assessment of Educational Progress (NAEP)*. NAEP SAIL is a hothouse dedicated to explorations in the cognitive sciences, assessment, and technology that will enable a continuously updated NAEP. The purpose of SAIL is to develop, fund, and manage a portfolio of innovative research and development efforts that look beyond the current capabilities of NAEP as a complex educational survey assessment. (2013-present)
2. I presented an invite keynote at the *National Science Education Leadership Association* in 2011 on the integration of argumentation and inquiry in the classroom.
3. I have published the findings and implications of my research for practitioners through the National Science Teacher Association and similar organizations in an attempt to increase the pragmatic impact of the research (Baker, Piburn, & Clark, 2005; Clark & Chaudury, 2008; Medina, Clark, & Ramirez, 2007; Sampson & Clark, 2007)
4. My research groups and collaborations provide the learning environments that we develop to all interested teachers over the Internet for free and provide free teacher training workshops. My research involves close, collaborative partnerships with classroom teachers. Not only do I conduct the actual research in classrooms around Nashville, but my grants also include money to hire practicing teachers to participate as members of our research team. These mechanisms for mentoring and teaching allow us to conduct complex interdisciplinary work that appropriately draws upon the distributed expertise of all participants while supporting the development and growth of all participants.
5. My work and perspectives are included as part of interviews in educational media such as *Physics Today*, *EdSURGE*, and *Mashable*. In 2013, the major daily newspaper in Israel (*The Marker*) ran a full-page story on my work and perspectives on educational technology and current reforms in Israel.