



Network for Information and Digital Access

The impact of Science Literacy delivery methods - what works?

Bibliography

Courses | Group 2. Education and training - including online

Ver. 1.00

Date: October 2018

Introduction

This thematic bibliography is the result of research to survey existing literature available on Science Literacy delivery methods.

The search was carried out by retrieving documents and articles from a wide range of sources, including research databases, Google Scholar, ResearchGate, subject databases, open access repositories etc. using keyword combinations.

The results of the resource discovery are divided into two groups: one containing impact assessments using qualitative, quantitative or mixed method (both qualitative and quantitative) approaches to data collection and a second including descriptive resources, which encompass, for example, reviews, guides, handbooks, reports and project reports.

This bibliography is work in progress and is not designed to be fully exhaustive or complete. We will be pleased to receive suggestions and recommendations for additions that can contribute to the understanding of science, its applications and, to the promotion of science literacy.

Groups and methods list

During the first part of the Desk Research phase of this project (i.e. Task 1), the team identified 42 single-mechanism approaches, 2 composite approaches and 1 related approach that were relevant to the delivery and dissemination of scientific information. The list of single mechanisms was further organised into 7 thematic groups, as presented in the following Table.

Single mechanism approach	Group
Exhibitions, Expo, Festivals, Movies, Picnics, Science fairs, Seminars, Talks, TED Talks, Theatre, Workshops	1. Events, meetings, performances
Colloquia, Courses, Curricula, E-learning, Webinars	2. Education and training – including online
Animations, Books, Brochures, Cartoons, Comics, Games, Graphics, Posters, Publications, Radio, Reports, TV, Videos	3. Traditional publishing and journalism – print and broadcast
Competitions, Experiments, Makerspaces, Mobile classrooms, Mobile laboratories	4. Activities and services
Blogs, E-books, E-zines, Mobile Apps, Podcasts, Social media, Websites, Wikis	5. Online interactions
Composite approaches	
Multiliteracies	
Multimodalities	
Related approach	
Citizen Science	

Attribution 4.0 International (CC BY 4.0)

Impact Assessment

- Abd-El-Khalick, Fouad, and Norman G. Lederman. "The Influence of History of Science Courses on Students' Views of Nature of Science." *Journal of Research in Science Teaching* 37, no. 10 (December 2000): 1057–95. [https://doi.org/10.1002/1098-2736\(200012\)37:10<1057::AID-TEA3>3.0.CO;2-C](https://doi.org/10.1002/1098-2736(200012)37:10<1057::AID-TEA3>3.0.CO;2-C).
- Baglin, J., A. Bedford, and M. Bulmer. "Students' Experiences and Perceptions of Using a Virtual Environment for Project-Based Assessment in an Online Introductory Statistics Course." In *Proceedings of the Roundtable Conference: Technology in Statistics Education (IASSE 2012)*, 1–29. Cebu City, The Philippines: International Association for Statistical Education (IASSE), 2012. <https://researchbank.rmit.edu.au/view/rmit:20956>.
- Biggs, Brandi L. "Basic Computer Literacy Training to Increase Comfort Levels with Computers and Improve Behaviors of Technological Integration." Master's thesis, Wichita State University, College of Education, Dept. of Curriculum and Instruction, 2006. <http://hdl.handle.net/10057/275>.
- Bjornsdottir, Audbjorg, Joan Garfield, and Michelle Everson. "Evaluating Two Models of Collaborative Tests in an Online Introductory Statistics Course." *Statistics Education Research Journal* 14, no. 1 (2015): 36–59. <https://eric.ed.gov/?id=EJ1065670>.
- Bowling, Bethany Vice, Erin E. Acra, Lihshing Wang, Melanie F. Myers, Gary E. Dean, Glenn C. Markle, Christine L. Moskalik, and Carl A. Huether. "Development and Evaluation of a Genetics Literacy Assessment Instrument for Undergraduates." *Genetics* 178, no. 1 (January 2008): 15–22. <https://doi.org/10.1534/genetics.107.079533>.
- Bowling, Bethany Vice, Carl A. Huether, Lihshing Wang, Melanie F. Myers, Glenn C. Markle, Gary E. Dean, Erin E. Acra, Francis P. Wray, and George A. Jacob. "Genetic Literacy of Undergraduate Non-Science Majors and the Impact of Introductory Biology and Genetics Courses." *BioScience* 58, no. 7 (July 1, 2008): 654–60. <https://doi.org/10.1641/B580712>.
- Bronwell, Sara E., Matthew J. Kloser, Tadashi Fukami, and Rich Shavelson. "Undergraduate Biology Lab Courses: Comparing the Impact of Traditionally Based 'Cookbook' and Authentic Research-Based Courses on Student Lab Experiences." *Journal of College Science Teaching* 41, no. 4 (2012): 36–45. <https://web.stanford.edu/~fukamit/brownell-et-al-2012.pdf>.
- Brownell, Sara E., Jordan V. Price, and Lawrence Steinman. "A Writing-Intensive Course Improves Biology Undergraduates' Perception and Confidence of Their Abilities to Read Scientific Literature and Communicate Science." *Advances in Physiology Education* 37, no. 1 (March 2013): 70–79. <https://doi.org/10.1152/advan.00138.2012>.
- Burch, Sarah L., and Sara E. Harris. "A Massive Open Online Course on Climate Change: The Social Construction of a Global Problem Using New Tools for Connectedness: A Massive Open Online Course on Climate Change." *Wiley Interdisciplinary Reviews: Climate Change* 5, no. 5 (September 2014): 577–85. <https://doi.org/10.1002/wcc.300>.
- Buxner, S.R., J. Antonellis, and C.D. Impey. "A 20-Year Study of Undergraduate Astronomy Students' Beliefs and Knowledge in Science and Technology," 434. Boulder, Colorado, 2011. <http://adsabs.harvard.edu/full/2011ASPC..443..434B>.
- Çalışkan, Sevilay. "The Effect of Inquiry-Based Chemistry Course on Students' Understanding of Atom Concept, Learning Approaches, Motivation, Self-Efficacy, and Epistemological Beliefs." Master's thesis, The Middle East Technical University, 2004. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.633.9203&rep=rep1&type=pdf>.
- Chambers, c. "A Pilot Study: The Use of a Survey to Assess the Food Knowledge of Nutrition Students at Various Levels of Nutrition Education." Master's thesis, University of Nebraska, 2012. <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1153&context=cehdiss>.

- Clary, Renee M. "Can the History of Geology Inform Geoscience Education and Public Reception of Climate Change? Lessons from the History of Glacial Theory." *Geosphere* 14, no. 2 (April 1, 2018): 642–50. <https://doi.org/10.1130/GES01461.1>.
- DelMas, Robert, Joan Garfield, Ann Ooms, and Beth Chance. "Assessing Students' Conceptual Understanding after a First Course in Statistics." *Statistics Education Research Journal* 6, no. 2 (November 1, 2007): 28–58. https://apps3.cehd.umn.edu/artist/articles/AERA_2006_CAOS.pdf.
- Devraj, Radhika, Lakesha M. Butler, Gireesh V. Gupchup, and Therese I. Poirier. "Active-Learning Strategies to Develop Health Literacy Knowledge and Skills." *American Journal of Pharmaceutical Education* 74, no. 8 (October 11, 2010): 137. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2987277/>.
- Dichev, Christo, and Darina Dicheva. "Towards Data Science Literacy." *Procedia Computer Science* 108 (2017): 2151–60. <https://doi.org/10.1016/j.procs.2017.05.240>.
- Dolničar, Danica, Bojana Boh Podgornik, and Tomaž Bartol. "A Comparative Study of Three Teaching Methods on Student Information Literacy in Stand-Alone Credit-Bearing University Courses." *Journal of Information Science* 43, no. 5 (October 2017): 601–14. <https://doi.org/10.1177/0165551516655084>.
- Ekborg, Margareta, and Mats Areskoug. "How Student Teachers' Understanding of the Greenhouse Effect Develops during a Teacher Education Programme." *Nordic Studies in Science Education* 2, no. 3 (October 26, 2012): 17. <https://doi.org/10.5617/nordina.411>.
- Engellant, Kevin. "A Quantitative Study with Online Collaborative Learning in a Computer Literacy Course." PhD thesis, University of Montana, 2014. https://scholarworks.umt.edu/etd/4389?utm_source=scholarworks.umt.edu%2Fetd%2F4389&utm_medium=PDF&utm_campaign=PDFCoverPages.
- Erlich, Zippy, Rivka Gadot, and Daphna Shahak. "The Effect of Computer Literacy Course on Students' Attitudes toward Computer Applications." *Journal of Educational Technology Systems* 37, no. 1 (September 2008): 83–95. <https://doi.org/10.2190/ET.37.1.g>.
- Freeman, S., S. L. Eddy, M. McDonough, M. K. Smith, N. Okoroafor, H. Jordt, and M. P. Wenderoth. "Active Learning Increases Student Performance in Science, Engineering, and Mathematics." *Proceedings of the National Academy of Sciences* 111, no. 23 (June 10, 2014): 8410–15. <https://doi.org/10.1073/pnas.1319030111>.
- Genç, Murat. "The Effect of Scientific Studies on Students' Scientific Literacy and Attitude." *Ondokuz Mayıs University Journal of Faculty of Education* 34, no. 1 (June 1, 2015): 141–42. <https://doi.org/10.7822/omuefd.34.1.8>.
- Gerlach, Karrie, Jaclyn Trate, Anja Blecking, Peter Geissinger, and Kristen Murphy. "Valid and Reliable Assessments To Measure Scale Literacy of Students in Introductory College Chemistry Courses." *Journal of Chemical Education* 91, no. 10 (October 14, 2014): 1538–45. <https://doi.org/10.1021/ed400471a>.
- Greer, Lisa, and Peter J. Heaney. "Real-Time Analysis of Student Comprehension: An Assessment of Electronic Student Response Technology in an Introductory Earth Science Course." *Journal of Geoscience Education* 52, no. 4 (September 2004): 345–51. <https://doi.org/10.5408/1089-9995-52.4.345>.
- Grewe, Kim, and William Preston Davis. "The Impact of Enrollment in an OER Course on Student Learning Outcomes." *The International Review of Research in Open and Distributed Learning* 18, no. 4 (June 16, 2017): 8. <https://doi.org/10.19173/irrodl.v18i4.2986>.

- Hahs-Vaughn, Debbie L., Hannah Acquaye, Matthew D. Griffith, Hang Jo, Ken Matthews, and Parul Acharya. "Statistical Literacy as a Function of Online Versus Hybrid Course Delivery Format for an Introductory Graduate Statistics Course." *Journal of Statistics Education* 25, no. 3 (September 2, 2017): 112–21. <https://doi.org/10.1080/10691898.2017.1370363>.
- Harvey, Barbara C. "Is It Scholarly?: A Lesson Plan for Collaborative Chemistry Information Literacy." In *ACS Symposium Series*, 1232:93–103. Washington, DC: American Chemical Society, 2016. <https://doi.org/10.1021/bk-2016-1232.ch004>.
- Hedges, Sarai. "Statistics Student Performance and Anxiety: Comparisons in Course Delivery and Student Characteristics." *Statistics Education Research Journal* 16, no. 1 (2017): 320–36. [https://iase-web.org/documents/SERJ/SERJ16\(1\)_Hedges.pdf](https://iase-web.org/documents/SERJ/SERJ16(1)_Hedges.pdf).
- Hekler, Eric B., Christopher D. Gardner, and Thomas N. Robinson. "Effects of a College Course About Food and Society on Students' Eating Behaviors." *American Journal of Preventive Medicine* 38, no. 5 (May 2010): 543–47. <https://doi.org/10.1016/j.amepre.2010.01.026>.
- Hestness, Emily, J. Randy McGinnis, Kelly Riedinger, and Gili Marbach-Ad. "A Study of Teacher Candidates' Experiences Investigating Global Climate Change Within an Elementary Science Methods Course." *Journal of Science Teacher Education* 22, no. 4 (June 15, 2011): 351–69. <https://doi.org/10.1007/s10972-011-9234-3>.
- Hoz, R., D. Bowman, and E. Kozminsky. "The Differential Effects of Prior Knowledge on Learning: A Study of Two Consecutive Courses in Earth Sciences." *Instructional Science* 29, no. 3 (May 2001): 187–211. <https://doi.org/10.1023/A:1017528513130>.
- Im, Soo-hyun, Joo-Yun Cho, Janet M. Dubinsky, and Sashank Varma. "Taking an Educational Psychology Course Improves Neuroscience Literacy but Does Not Reduce Belief in Neuromyths." Edited by Bert De Smedt. *PLOS ONE* 13, no. 2 (February 5, 2018): e0192163. <https://doi.org/10.1371/journal.pone.0192163>.
- Jin, Guang, and Tom Bierma. "STEM for Non-STEM Majors: Enhancing Science Literacy in Large Classes." *Journal of College Science Teaching* 042, no. 06 (2013): 20–26. https://doi.org/10.2505/4/jcst13_042_06_20.
- Karimi, Zohreh, Hasan Ashrafi-Rizi, Ahmad Papi, Leila Shahrzadi, and Akbar Hassanzadeh. "Effect of Information Literacy Training Course on Information Literacy Skills of Undergraduate Students of Isfahan University of Medical Sciences Based on ACRL Standards." *Journal of Education and Health Promotion* 4 (2015): 76. <https://doi.org/10.4103/2277-9531.171789>.
- King, Jordan A., and Rebecca L. Frazen. "Environmental Literacy in Environmentally Themed Higher Education Courses." *Journal of Sustainability Education* 13 (March 2017). http://www.susted.com/wordpress/wp-content/uploads/2017/03/King-and-Franzen-JSE-March-2017_Future-Casting-Issue-PDF1.pdf.
- Lambert, Julie. "High School Marine Science and Scientific Literacy: The Promise of an Integrated Science Course." *International Journal of Science Education* 28, no. 6 (May 12, 2006): 633–54. <https://doi.org/10.1080/09500690500339795>.
- Lantzy, Tricia. "Health Literacy Education: The Impact of Synchronous Instruction." *Reference Services Review* 44, no. 2 (June 13, 2016): 100–121. <https://doi.org/10.1108/RSR-02-2016-0007>.
- Lau, Kwok-chi. "Impacts of a STSE High School Biology Course on the Scientific Literacy of Hong Kong Students." *Asia-Pacific Forum on Science Learning and Teaching* 14, no. 1, Article 6 (2013): 25. <https://eric.ed.gov/?id=EJ1017382>.

- Libarkin, Julie C., and Steven W. Anderson. "Assessment of Learning in Entry-Level Geoscience Courses: Results from the Geoscience Concept Inventory." *Journal of Geoscience Education* 53, no. 4 (September 2005): 394–401. <https://doi.org/10.5408/1089-9995-53.4.394>.
- Locknar, Angela, Rudolph Mitchell, Janet Rankin, and Donald R. Sadoway. "Integration of Information Literacy Components into a Large First-Year Lecture-Based Chemistry Course." *Journal of Chemical Education* 89, no. 4 (March 13, 2012): 487–91. <https://doi.org/10.1021/ed200252q>.
- . "Survey Study of the Integration of Information Literacy Components into the First-Year Solid State Chemistry Course." *American Chemical Society*, no. 2012–03 (March 2012): 487–91. <http://hdl.handle.net/1721.1/79801>.
- Lovett, Marsha, Oded Meyer, and Candace Thille. "JIME - The Open Learning Initiative: Measuring the Effectiveness of the OLI Statistics Course in Accelerating Student Learning." *Journal of Interactive Media in Education* 2008, no. 1 (May 20, 2008): 13. <https://doi.org/10.5334/2008-14>.
- Mackin, Kathleen J., Nancy Cook-Smith, Lodovica Illari, John Marshall, and Philip Sadler. "The Effectiveness of Rotating Tank Experiments in Teaching Undergraduate Courses in Atmospheres, Oceans, and Climate Sciences." *Journal of Geoscience Education* 60, no. 1 (February 16, 2012): 67–82. <https://doi.org/10.5408/10-194.1>.
- Mandernach, Meris A., Yasmeen Shorish, and Barbara Reisner. "The Evolution of Library Instruction Delivery in the Chemistry Curriculum Informed by Mixed Assessment Methods." *Issues in Science & Technology Librarianship* 77 (2014): 21. <https://doi.org/10.5062/f46h4fdd>.
- Martinez-dawson, Rose. "The Effects of a Course on Statistical Literacy upon Students' Challenges to Statistical Claims Made in the Media." PhD thesis, Clemson University, 2010. https://tigerprints.clemson.edu/all_dissertations/616.
- Matkins, Juanita Jo, and Randy L. Bell. "Awakening the Scientist Inside: Global Climate Change and the Nature of Science in an Elementary Science Methods Course." *Journal of Science Teacher Education* 18, no. 2 (April 9, 2007): 137–63. <https://doi.org/10.1007/s10972-006-9033-4>.
- Medina, Stephanie R., Evan Ortlieb, and Sandra Metoyer. "Life Science Literacy of an Undergraduate Population." *The American Biology Teacher* 76, no. 1 (January 2014): 34–41. <https://doi.org/10.1525/abt.2014.76.1.8>.
- Meichtry, Yvonne J. "The Nature of Science and Scientific Knowledge: Implications for Designing a Preservice Elementary Methods Course." *Science and Education* 8, no. 3 (May 1999): 273–86. <https://link.springer.com/article/10.1023/A:1008693930840>.
- Mercy O., Nani. "Relationship between Nutrition Knowledge and Food Intake of College Students." Master's thesis, Kent State University, 2016. http://rave.ohiolink.edu/etdc/view?acc_num=kent1469155764.
- Mihalopoulos, Cleopatra C., Mary F. Powers, Aaron J. Lengel, and Michelle N. Mangan. "Impact of a Health Literacy Training Course on Community Pharmacists' Health Literacy Knowledge and Attitudes." *Journal of Pharmacy Technology* 29, no. 6 (December 2013): 283–89. <https://doi.org/10.1177/8755122513502455>.
- Momsen, Jennifer L., Scott K. Clark, Jennifer H. Doherty, Kevin C. Haudek, Jonathon W. Schramm, and Emily M. Geraghty Ward. "Lost in Translation: Quantifying the Overlap of Popular Media and Non-Majors Science Course Assessment Vocabulary." *Ecosphere* 3, no. 5 (May 2012): art43. <https://doi.org/10.1890/ES11-00311.1>.
- Nam, Y., and E. Ito. "A Climate Change Course for Undergraduate Students." *Journal of Geoscience Education* 59, no. 4 (November 14, 2011): 229–41. <https://doi.org/10.5408/1.3651405>.

- O'Sullivan, M.L. "Effects of Inquiry Based Laboratory Experiments on Students' Comprehension of Biological Principles in a University Level Biology Course." Master's thesis, Montana State University, 2012. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.425.5965&rep=rep1&type=pdf>.
- Otto, Daniel. "MOOCs—A Powerful Tool for Imparting Climate Literacy? Insights from Parleys with Students." In *Climate Literacy and Innovations in Climate Change Education*, 131–49. Cham: Springer International Publishing, 2018. https://doi.org/10.1007/978-3-319-70199-8_8.
- Pan, Denise, Ignacio J. Ferrer-Vinent, and Margret Bruehl. "Library Value in the Classroom: Assessing Student Learning Outcomes from Instruction and Collections." *The Journal of Academic Librarianship* 40, no. 3–4 (May 2014): 332–38. <https://doi.org/10.1016/j.acalib.2014.04.011>.
- Papastergiou, Marina. "Enhancing Physical Education and Sport Science Students' Self-Efficacy and Attitudes Regarding Information and Communication Technologies through a Computer Literacy Course." *Computers & Education* 54, no. 1 (January 2010): 298–308. <https://doi.org/10.1016/j.compedu.2009.08.015>.
- Paul, Warren, and R Clare Cunnington. "An Exploration of Student Attitudes and Satisfaction in a GAISE-Influenced Introductory Statistics Course." *Statistics Education Research Journal*, 16, no. 2 (November 1, 2017): 487–510. [https://iase-web.org/documents/SERJ/SERJ16\(2\)_Paul.pdf](https://iase-web.org/documents/SERJ/SERJ16(2)_Paul.pdf).
- Rebich, Stacy, and Catherine Gautier. "Concept Mapping to Reveal Prior Knowledge and Conceptual Change in a Mock Summit Course on Global Climate Change." *Journal of Geoscience Education* 53, no. 4 (September 2005): 355–65. <https://doi.org/10.5408/1089-9995-53.4.355>.
- Reed, David, and Mark Lyford. "Science Courses for Nonscience Majors: How Much Impact Can One Class Make?" *Bulletin of the American Meteorological Society* 95, no. 8 (August 2014): 1209–12. <https://doi.org/10.1175/BAMS-D-13-00003.1>.
- Regassa, Laura B., and Alison I. Morrison-Shetlar. "Student Learning in a Project-Based Molecular Biology Course." *Journal of College Science Teaching* 38, no. 6 (2009): 58–67. http://wiki.biologyscholars.org/@api/deki/files/1100/=Regassa_%2526_Morrison-Shetlar_Capstone_Article_2012.pdf.
- Reidel, J. "Effects of an Introductory Agricultural Education Course on Agricultural Literacy and Perceptions of Agriculture in Urban Students ." Master's thesis, North Carolina State University, 2006. <http://www.lib.ncsu.edu/resolver/1840.16/1536>.
- Richards-Kortum, Rebecca, Deanna Buckley, Richard A. Schwarz, E. Neely Atkinson, and Michele Follen. "A Translational Bioengineering Course Provides Substantial Gains in Civic Scientific Literacy." *Annals of Biomedical Engineering* 35, no. 8 (July 13, 2007): 1324–32. <https://doi.org/10.1007/s10439-007-9319-5>.
- Ristanto, Rizhal, Siti Zubaidah, Mohamad Amin, and Fatchur Rohman. *Scientific Literacy of Students Learned Through Guided Inquiry*. Vol. 4, 2017. https://www.researchgate.net/publication/322274444_Scientific_Literacy_of_Students_Learned_Through_Guided_Inquiry.
- Roberts, Jacqueline R., Eric Hagedorn, Paul Dillenburg, Michael Patrick, and Timothy Herman. "Physical Models Enhance Molecular Three-Dimensional Literacy in an Introductory Biochemistry Course*." *Biochemistry and Molecular Biology Education* 33, no. 2 (November 3, 2006): 105–10. <https://doi.org/10.1002/bmb.2005.494033022426>.
- Rossi, A. Hassad. "An Exploration of the Perceived Usefulness of the Introductory Statistics Course and Students' Intentions to Further Engage in Statistics." *Numeracy* 11, no. 1 (January 2018): 12. <https://doi.org/10.5038/1936-4660.11.1.7>.

- Schreinemachers, Pepijn, Marie Antoinette Patalagsa, and Nasir Uddin. "Impact and Cost-Effectiveness of Women's Training in Home Gardening and Nutrition in Bangladesh." *Journal of Development Effectiveness* 8, no. 4 (October 2016): 473–88. <https://doi.org/10.1080/19439342.2016.1231704>.
- Treacy, Daniel J., Saumya M. Sankaran, Susannah Gordon-Messer, Danielle Saly, Rebecca Miller, Stefan R. Isaac, and Melissa S. Kosinski-Collins. "Implementation of a Project-Based Molecular Biology Laboratory Emphasizing Protein Structure–Function Relationships in a Large Introductory Biology Laboratory Course." Edited by Debra Tomanek. *CBE—Life Sciences Education* 10, no. 1 (March 2011): 18–24. <https://doi.org/10.1187/cbe.10-07-0085>.
- Veron, Dana, Gili Marbach-Ad, Jane Wolfson, and Gulnihal Ozbay. "Assessing Climate Literacy Content in Higher Education Science Courses: Distribution, Challenges, and Needs." *Journal of College Science Teaching* 045, no. 06 (2016): 43–49. https://doi.org/10.2505/4/jcst16_045_06_43.
- Walker, J. D., Sehoya H. Cotner, Paul M. Baepler, and Mark D. Decker. "A Delicate Balance: Integrating Active Learning into a Large Lecture Course." Edited by Marshall Sundberg. *CBE—Life Sciences Education* 7, no. 4 (December 2008): 361–67. <https://doi.org/10.1187/cbe.08-02-0004>.
- Wallace, Patricia, and Roy B. Clariana. "Perception versus Reality—Determining Business Students' Computer Literacy Skills and Need for Instruction in Information Concepts and Technology." *Journal of Information Technology Education: Research* 4 (January 2005): 141–151. <https://www.learntechlib.org/p/111567>.
- Wilkins, Jesse L. M., and Brenda R. Brand. "Change in Preservice Teachers' Beliefs: An Evaluation of a Mathematics Methods Course." *School Science and Mathematics* 104, no. 5 (May 2004): 226–32. <https://doi.org/10.1111/j.1949-8594.2004.tb18245.x>.
- Zeigler, Laura Ann. "Reconceptualizing Statistical Literacy: Developing an Assessment for the Modern Introductory Statistics Course." PhD thesis, University of Minnesota, 2014. <http://hdl.handle.net/11299/165153>.

Descriptive Resources

- Brey, James A., Ira W. Geer, and Elizabeth W. Mills. "Using Real-World Data to Increase Students' Scientific Literacy." San Diego, CA, USA: IEEE, 2013. <https://ieeexplore.ieee.org/document/6741055/>.
- Brey, James A., Ira W. Geer, Elizabeth W. Mills, Kira A. Nugnes, and Anupa Asokan. "Energizing Students' Earth Science Literacy," 1–6. St. John's, NL, Canada: IEEE, 2014. <https://doi.org/10.1109/OCEANS.2014.7003014>.
- Brownell, Sara E., Jordan V. Price, and Lawrence Steinman. "Science Communication to the General Public: Why We Need to Teach Undergraduate and Graduate Students This Skill as Part of Their Formal Scientific Training." *Journal of Undergraduate Neuroscience Education: JUNE: A Publication of FUN, Faculty for Undergraduate Neuroscience* 12, no. 1 (2013): E6–10. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3852879/>.
- Budgett, Stephanie, and Maxine Pfannkuch. "Assessing Students' Statistical Literacy." In *Assessment Methods in Statistical Education*, edited by Penelope Bidgood, Neville Hunt, and Flavia Jolliffe, 103–21. Chichester, UK: John Wiley & Sons, Ltd, 2010. <https://doi.org/10.1002/9780470710470.ch9>.
- E. Klobas, Jane. "Measuring the Success of Scaleable Open Online Courses." *Performance Measurement and Metrics* 15, no. 3 (November 4, 2014): 145–62. <https://doi.org/10.1108/PMM-10-2014-0036>.
- Hobson, Art. "The Surprising Effectiveness of College Scientific Literacy Courses." *The Physics Teacher* 46, no. 7 (October 2008): 404–6. <https://doi.org/10.1119/1.2981285>.

- Kelly, Jennifer, Aaron McCright, and Thomas Dietz. "Climate Change and Society: Toward Online Pedagogy." *Human Ecology Review* 21, no. 2 (2015): 49–64. <https://www.jstor.org/stable/24875132>.
- Loo, Jeffery L. "Guided and Team-Based Learning for Chemical Information Literacy." *The Journal of Academic Librarianship* 39, no. 3 (May 2013): 252–59. <https://doi.org/10.1016/j.acalib.2013.01.007>.
- Nanayakkara, Janandani, Claire Margerison, and Anthony Worsley. "Teachers' Perspectives of a New Food Literacy Curriculum in Australia." *Health Education* 118, no. 1 (January 2, 2018): 48–61. <https://doi.org/10.1108/HE-05-2017-0024>.