

◦ **Anthony (Tony, he/him/his) Edward Butterfield** ◦
 Associate Professor (Lecturer), Department of Chemical Engineering, University of Utah
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Education

Doctor of Philosophy	Chemical Engineering	University of Utah	2008
Master of Science	Chemical Engineering	UC, San Diego	1999
Bachelor of Science	Chemical & Fuels Engineering	University of Utah	1996

Teaching Experience

Associate Professor (Lecturer) *2016 - Present*
 Department of Chemical Engineering, University of Utah, Salt Lake City, UT

- *Courses Taught:* Undergraduate Projects Laboratory & Capstone Project Series, Introduction to Chemical Engineering, Chemical Engineering Design & Innovation (1st year engineering design laboratory).
- *Key Accomplishments:* Designed and oversaw construction of the Meldrum Innovation Laboratory, a maker and instructional space designed specifically to enhance chemical engineering undergraduate curriculum and develop a healthy, welcoming department culture. Aided in development efforts to make this unique educational space a reality for our students. Evidence suggests this space has boosted student lab skill acquisition by around 50%, improved associated course evaluations, and strengthened student community.

Assistant Professor (Lecturer) *2010 - 2016*
 Department of Chemical Engineering, University of Utah, Salt Lake City, UT

- *Courses Taught:* Undergraduate Projects Laboratory & Capstone Project Series, Introduction to Chemical Engineering, Chemical Engineering Design & Innovation.
- *Key Accomplishments:* Designed and implemented an original course for first-year students in the chemical engineering program, Chemical Engineering Design & Innovation, using evidence-based pedagogy (project-based, open-ended, active learning). This course has demonstrably improved student conceptual learning by approximately 30%, boosted average student course evaluations in the first year curriculum, and garnered several university and national awards. Initiated an ongoing internship program with a local Title I high school.

Associate Instructor *2009 - 2010*
 Department of Chemical Engineering, University of Utah, Salt Lake City, UT

- *Courses Taught:* Undergraduate Projects Laboratory & Capstone Project Series.
- *Key Accomplishments:* Significantly improved course evaluations for what had been a particularly difficult laboratory series. Initiated an robust, sustained community outreach program that continues to directly impact thousands of K-12 students, focusing particularly on underrepresented communities.

Industry Experience

Consultant 2009 - 2010

Fey Financial Engineering, Salt Lake City, UT

- Developed proprietary algorithms to aid in investment decisions, as a joint effort between Fey Financial Engineering and the University of Utah.

Researcher 1996 - 1997

Becton Dickenson, Sandy, UT

- Managed an extensive study on the effectiveness of various surface treatment on long-term implantable catheters, using SEM, FTIR, Instron, and various other analytical tools. This proprietary work resulted in identification of treatments that would limit biofilm formation and lead to improved outcomes for patients experiencing chronic illnesses.

Research Associate 1995 - 1996

United States Bureau of Mines, Salt Lake City, UT

- Characterized the ability of immobilized protein columns to selectively remove and concentrate heavy metal contaminants from electroplating waste water.

Service Experience

External Service:

- *AIChE Societal Impact Operating Counsel, Member & 1st Chair* 2016 to present
Advise AIChE on matters of importance in the interactions between the chemical engineering profession and our society at large. Founding Chair of AIChE's LGBTQ+ & Allies Initiative; awarded four successful proposals for LGBTQ+ and allies programming at the national conference. Perform trainings for AIChE professionals on best practices for inclusion and recruitment of LGBTQ+ engineers. Elected to become Chair of this operating counsel in 2021.
- *Chemical Engineering Division of ASEE, Member & Vice Chair* 2015 to present
Maintain the division web presence, conduct elections, attend annual meetings, maintain division historical and awards records, and advise the chair.
- *NOGLSTP Affiliations Subcommittee* 2018 to present
Aid NOGLSTP in creating affiliations with science and engineering professional organizations. Attend board meetings. Initiated an affiliation and MOU between AIChE and NOGLSTP, announced at the AIChE Annual Meeting.
- *ASEE Summer School Instructor* 2017
Invited as an instructor to conduct several workshops on first-year chemical engineering education and creating a welcoming department environment for LGBTQ+ students.

Internal Service:

- Department of Chemical Engineering, University of Utah:
 - *P-14 & Community Outreach Director* 2012 to present
Created and manage a team of undergraduate students who travel to local schools and community events with interactive teaching modules to develop interest in engineering fields, focusing on communities that have been historically

underrepresented in engineering disciplines. Conduct two to four summer camps each year and organize our department's participation in many outreach events: the Science Olympiad, Engineering Day, the Major Expo, Girl Scout Night, Utah STEM Fest, and more. This group visits thousands of students each year and has spanned territory from Southern Utah up to the Arapaho Nation in Wyoming.

- Outreach team has been awarded first place prizes in the AIChE K-12 Showcase for each of the two years this competition has existed.
- *Advisor for the AIChE Student Chapter* 2012 to present
Aid students in group decisions, arrange for and chaperone trips to regional and national conferences. Received the 2013 Outstanding Chapter Award from AIChE.
- *Advisor for the AIChE ChemE Car Team* 2011 to present
Advise on car safety and engineering, and student group management. Arrange travel and chaperone students to the annual regional meeting. Evaluate engineering documentation packages for competing schools, and act as a safety judge for regional and national AIChE Chem E Car competitions.
- *Member of Undergraduate Subcommittee* 2013 to present
Advise on curricular matters of importance to our undergraduate community.
- *Director of the Chem Eng High School Internship Program* 2013 to present
Each year this program takes on about twenty interns from local high schools (primarily AMES high school, a Title I school with a focus on STEM disciplines). This work has resulted in bringing many of our most talented undergraduates into our department, of which several have authored peer reviewed papers before their college careers.
- College of Engineering, University of Utah:
 - *Director of Fellowships* 2017 to 2019
Maintain a list of fellowships on the COE web site. Conduct approximately 6 fellowship workshops per year. Since beginning this activity we have gone from having one NSF GRFP winner in our department ever, to having one or two every year. Working other colleges to create a university-wide fellowships program.
 - College of Engineering Teaching Excellence Committee 2016 to 2019
Evaluate student proposals for undergraduate research funding.
- University of Utah:
 - *oSTEM Advisor* 2014 to present
Founding faculty advisor for this student group for LGBTQ+ students and allies in STEM fields. Advise the club on events, and aid them in securing funding and space. Organized a LGBTQ+ in STEM day with faculty trainings and roundtable lunch, demonstrably improving college climate for LGBTQ+ students. Organized outreach to the local LGBTQ+ youth group at Salt Lake City's LGBTQ+ Resource Center to develop interest in STEM fields among this underrepresented community and send a welcoming message. Represented oSTEM with a booth at the Utah Pride Festival.

Honors & Awards

NATIONAL AWARDS & HONORS

The Robert G. Quinn Award

2020

American Society of Engineering Education (ASEE)

National award for "outstanding contributions in experimentation and laboratory instruction."

This award focused on contributions made to chemical engineering education through the introduction of hands-on chemical engineering design and innovation to first-year students.

Innovation in Chemical Engineering Education Award 2017

American Institute of Chemical Engineers (AIChE)

National award for “an individual who has implemented a pedagogical innovation into a class or course that has made a significant and documented positive impact on teaching effectiveness and has enhanced student learning.” Recognition was specifically for work introducing maker-space projects to chemical engineering curriculum, development of effective K-12 outreach models, and efforts retaining underrepresented students.

GLBT Educator of the Year Award 2017

National Organization of Gay & Lesbian Scientists & Technical Professionals (NOGLSTP)

National award to the GLBT Educator who has made the most outstanding contributions to education in their field that year.

William H Corcoran Award 2019

American Society of Engineering Education (ASEE)

Awarded for best 2019 paper in the journal Chemical Engineering Education, for the work: *Building Air Quality Sensors and Inspiring Citizen Scientists*.

Best Poster 2018

American Society of Engineering Education (ASEE)

Awarded for best poster at the ASEE annual conference in the Chemical Engineering Division, for the work: *Online Homework System in a Chemical Engineering Curriculum*.

First Featured LGBTQ+ Chemical Engineer Profile 2017

American Institute of Chemical Engineers

The first out LGBTQ+ chemical engineer to be featured by AIChE, as an effort to make the profession of chemical engineering more welcoming to all.

<https://www.aiche.org/chenected/2017/02/tony-butterfield-featured-lgbtq-cheme-professional>

UNIVERSITY AWARDS & HONORS

University of Utah's Distinguished Teaching Award 2020

University of Utah

Awarded university-wide for “a consistent record of outstanding teaching performance and implement effective and innovative teaching methods which demonstrate exceptional abilities to motivate student learning.”

Beacons of Excellence Award 2015

University of Utah

University-wide award for Recognizing excellence in providing “transformational experiences” to undergraduate students. Awarded specifically for new course development, K-12 outreach, advising, and mentoring programs.

Career Services Faculty Recognition Award 2016

University of Utah, Career Services

An award meant to recognize faculty members who are uniquely contributing to students' career development and exploration.

Outstanding Teaching Award 2013

University of Utah, College of Engineering

A college-wide award meant to recognize extraordinary teaching.

Outstanding Faculty Award

2013, 2016, & 2020

University of Utah, Department of Chemical Engineering

Department award determined by popular vote of the graduating class, for effectiveness in teaching and mentoring.

Outstanding Instructor Award

2011

University of Utah, Department of Chemical Engineering

Awarded by popular vote of the graduating class for effectiveness in teaching and mentoring.

Funding Received

Support for Community Outreach for the DOE FORGE project. The Governor's Office of Energy Development. \$22,000.

- Created multiple teaching modules, with an undergraduate assistant, meant to aid K-12 schools to communicate the importance of green geothermal energy, and develop interest in STEM fields.

EAGER: AirU: Community Network to Understand Air Quality and Sensor Reliability. PI: Kerry Kelly. Co-PI(s): Anthony Butterfield. NSF, 10/01/2016 - 09/30/2018. Total project budget to date: \$99,617.00.

- Created teaching modules, with the aid of high school interns, used engage local middle and high school students in citizen science to aid in the study of Salt Lake County air quality.
- Part of this work was awarded the 2017 Corcoran Award from the American Society of Engineering Educators.

Active Learning for Freshmen Chemical Engineers through a Design Laboratory.

University of Utah: Undergraduate Student Experts in Teaching (USET) program. Total project budget to date: \$1,500.

- Worked with an undergraduate to develop various teaching modules for our first-year design course, which has received national award recognition.

STEP: Utah's Engineers. Co-PI. National Science Foundation, 9/01/2007 - 09/30/2014. Total project budget to date: \$206,404.00. Share project budget: \$103,202.00.

- Development of a chemical engineering outreach program. We were required to create 3 teaching modules and visit at least 100 students in their classrooms. Over 30 teaching modules were developed and over 3,000 students were visited in their classrooms, leading to our sustained Chemical Engineering Outreach program.

College Base Engineering Equipment Fund. Approximately \$100,000 every year since 2010: \$66,000 from the College of Engineering and \$33,000 in department matching funds.

- These funds, totaling well over \$700,000 to date, have been used to improve the capabilities of our undergraduate teaching laboratories, develop new courses, and improve the employability of our students.

Publications

Butterfield, A. (2020, June), The Design and Impact of a Combined Makerspace, Wet Lab, and Instructional Design Studio for Chemical Engineering Curriculum Paper presented at 2020 ASEE Virtual Annual Conference Content Access, Virtual On line. 10.18260/1-2—3530.

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Moore, J. A., & Dailey, M., & Wilhelm, Z., & Kelly, K., & Goffin, P., & **Butterfield, A.**, & Wiese, J., & Xing, W., & Le, K. M., & Becnel, T., & Gaillardon, P. (2020, June), "WIP: Engaging Pre-college Students in Hypothesis Generation Using a Citizen Scientist Network of Air Quality Sensors," Paper presented at 2020 ASEE Virtual Annual Conference Content Access, Virtual On line. 10.18260/1-2--35538

Butterfield, A., Katrina Le, Kerry Kelly (2018). Citizen Scientists Engagement in Air Quality Measurements. American Society of Engineering Educators. Article, Refereed Conference Proceedings, Published, 06/25/2018.

- Won the 2019 Corcoran Award for best paper in Chemical Engineering Education

Sayahi, T., **Butterfield, A.** & Kelly, K. (2019). Long-term field evaluation of the Plantower PMS low-cost particulate matter sensors. Environmental Pollution. Vol. 245, 932-940. Journal Article, Published, 02/2019.

Branch, K., **Butterfield, A.** (2018). Modeling Student Performance in an Introductory Chemical Engineering Course. American Society of Engineering Educators. Article, Refereed Conference Proceedings, Published, 06/26/2018.

Butterfield, A. "Implementation and Usage of an Online Environment in a Chemical Engineering Curriculum." ASEE Annual Conference, New Orleans. Article, Refereed Conference Proceedings, Published, 06/2016.

Butterfield A., K. Branch, "Collaboration between Seniors & Freshmen on Senior Capstone Projects." ASEE Annu Conf Expo, New Orleans. Article, Refereed Conference Proceedings, Published, 06/2016.

Butterfield A., K. Branch, "Results & Lessons Learned from a Chemical Engineering Freshman Design Laboratory", 2015 ASEE Annu Conf Expo. doi:10.18260/p.24674. 2015. Article, Refereed Conference Proceedings, Published, 06/2015.

K. Branch, **Butterfield A.**, "Analysis of Student Interactions with Browser-Based Interactive Simulations Analysis of Student Interactions with Browser-Based Interactive Simulations." ASEE Annu Conf Expo. doi:10.18260/p.23553. 2015. Article, Refereed Conference Proceedings, Published, 06/2015.

Tseng, Yen-Hsun, Tyler Lee, Samuel Doane, **Butterfield, A.**, John McLennan, Swomitra Mohanty & Leonard Pease (2019). Periodic symmetry defined bioreactors enhance algae growth. Environmental Science: Water Research & Technology. Article, Refereed Journal, Published, 04/24/2019.

Lê, K. , **Butterfield, A.**, Kelly, K., Gaillardon, P., Tingey, K. & Becnel, T. (2018). Building Air Quality Sensors & Inspiring Citizen Scientists. Chemical Engineering Education. Vol. 52, 193-201. Article, Refereed Journal, Published, 06/2018.

Butterfield, A., McCormick, A. & Farrell, A. (2018). Building LGBTQ-Inclusive Chemical Engineering Classrooms and Departments. Chemical Engineering Education. Vol. 52, 107-113. Article, Refereed Journal, Published, 03/2018.

Kelly, K., Jonathan Whitaker, J., Widmer, C., Dybwad, A., **Butterfield, A.** (2017). Ambient and laboratory evaluation of a low-cost particulate matter sensor. Environmental Pollution. Vol. 221, 491-500. Article, Refereed Journal, Published, 02/2017.

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Branch, K., **Butterfield, A.** (2016). Analysis of Student Interactions with Browser-Based Interactive Simulations. *Computers in Education Journal*. Vol. 7, 29-26. Article, Refereed Journal, Published, 06/2016.

Hillard, J., Branch, K., & **Butterfield, A. E.**, The Ball-In-Tube-Device; A New Approach to Introductory Fluid Dynamics Education. *International Journal of Mechanical Engineering Education*, 43 (1), pp 15-22, 2015. Article, Refereed Journal, Published, 10/07/2015.

Butterfield, A. , Branch, K., & Trujillo, E. (2014). First-Year Hands-On Design Course: Implementation & Reception. *Chemical Engineering Education*, 49(1), 19–26. Article, Refereed Journal, Published, 02/2015.

Chernyshev, V.; Rachamadugu, R.; Tseng, Y.; Belnap, D.; Jia, Y.; Branch, K.; **Butterfield, A.**; Pease, L.; Bernard, P.; Skliar, M., "Size and Shape Characterization of Hydrated and Desiccated Exosomes", *Analytical and bioanalytical chemistry*, 407(12): 3285-3301. 2015. Article, Refereed Journal, Published, 01/26/2015.

C. Young, **Butterfield, A.** "Effective Engineering Outreach through an Undergraduate Mentoring Team and Module Database", *Chemical Engineering Education*, 48 (1), pp 31, 2014. Article, Refereed Journal, Published, 02/2014.

Jia, Y., Puga, M., **Butterfield, A.**, Christensen, D., Whitty, K., Skliar, M., Ultrasound Measurements of Temperature Profile Across Gasifier Refractories: Method and Initial Validation, DOI: 10.1021/ef3021206, *Energy & Fuels*, March 8, 2013. Article, Refereed Journal, Published, 11/2013.

Butterfield, A., C. Young "An Effective and Economical Photometer for Classroom Demonstrations and Laboratory Use." *Chemical Engineering Education*, 46(3), pp 152, 2012. Article, Refereed Journal, Published, 06/2012.

Butterfield, A., Stewart, R.J., Schmidt, C.F., and Skliar, M., "Bidirectional Power Stroke by Ncd Kinesin, *Biophysical Journal*," 99 (12), 3905-3915, 2010. Article, Refereed Journal, Published, 12/2010.

Kandadai, M.A., Mohan, P., Lin, G., **Butterfield, A.**, Skliar, M., and J. Magda, J., "Comparison of Surfactants Used to Prepare Aqueous Perfluoropentane Emulsions for Pharmaceutical Applications," *Langmuir*, 26 (7), pp 4655–4660, 2010. Article, Refereed Journal, Published, 03/10/2010.

Presentations

Butterfield, A., "Incorporating Diversity Equality & Inclusion Training into First-Year Chemical Engineering Curriculum," 2020 AIChE Annual Meeting, Presented Online. 11/19/2020.

Sayahi, T., Garff, A., Quah, T., Le, K., Becnel, T., Powell, K., Gaillardon, P., **Butterfield, A.**, Kelly, K., "Long-Term Calibration Models to Predict Ozone Levels with a Metal Oxide Sensor," 2020 AIChE Annual Meeting, Presented Online. 11/16/2020

Butterfield, A. "Using the Trolley Problem in Chemical Engineering Ethics Education." In 2019 AIChE Annual Meeting. AIChE, 2019. 11/2019.

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Moore, J., Xing, W., Dailey, M., Le, K., Becnel, T., Goffin, P., Meyer, M., **Butterfield, A.** Kelly, K. "Engaging Middle and High School Students in Hypothesis Generation Using a Citizen-Scientist Network of Air Quality Sensors." In 2019 AIChE Annual Meeting. AIChE, 2019. 11/2019.

Butterfield, A., & Simonson, A. (2019, November). Outreach Methods and Modules in Partnership with a Geothermal Research Program. In 2019 AIChE Annual Meeting. AIChE. 11/2019.

Stephanie, F., Gibson, G., and **Butterfield, A.** "LGBTQ+ Inclusion in Engineering." In 2019 AIChE Annual Meeting. AIChE, 2019. 11/2019.

Kelly, K., Xing, W., Goffin, P., Sayahi, T., Becnel, T., Gaillardon, P., **Butterfield, A.**, Meyer, M., Whitaker, R. "Understanding How Pollution Episodes Affect Community-Level Air Quality with a Distributed Sensor Network." In 2019 AIChE Annual Meeting. AIChE, 2019. 11/2019.

Kaufman, D., Sayahi, T., Kelly, K., **Butterfield, A.**, Gaillardon, P., Becnel, T. "Development of a Calibration Chamber to Evaluate the Performance of Low-Cost Particulate Matter Sensors" In 2019 AIChE Annual Meeting. AIChE, 2019. 11/2019.

Wilkerson, S., Kelly, K., **Butterfield, A.**, Using Air-Quality Challenges to Engage Students in Science and Engineering. National Science Teacher's Association, Annual Meeting, Salt Lake City, Utah, October 25, 2019. 10/26/2019.

Branch, K., **Butterfield, A.**, Photobioreactor Design and Biodiesel Synthesis, 2018 AIChE National Conference, Pittsburgh, Pa. 10/30/2018.

Butterfield, A. (Panelist), Broadening Participation in Chemical Engineering: Outreach Efforts that Work; Programs, Best Practices, and Lessons Learned; AIChE Annual Meeting, Minneapolis, Mi. 10/31/2017.

Butterfield, A., Using Microcontrollers to Improve Learning and Engagement in Chemical Engineering Classrooms, Sponsored Webinar for the American Institute of Chemical Engineers. 10/08/2017.

Butterfield, A., K. Branch, "A Collection of Virtual Experiments with Tracking of Student Interaction Data," AIChE Annual Meeting, 2015. 10/2015.

Butterfield, A., K. Branch, "Laser Cut Microfluidics Projects for Undergraduate Teaching Laboratories," AIChE Annual Meeting, 2015. 10/2015.

Butterfield, A., K. Branch, "Tracking Students' Use of Online Simulation Applets," AIChE Annual Meeting, 2015. 10/2015.

Branch, K., **Butterfield, A.**, "Managing Expanding Class Sizes in an Expanding Chemical Engineering Laboratory," AIChE Annual Meeting, 2015. 10/2015.

Butterfield, A., K. Branch, (2014). Building Chemical Engineering Students from Miscellaneous Parts & Vague Instructions: A Hands-on First-Year Design Laboratory. In AIChE Annual Meeting (p. 686e). 11/2014.

Hillard, J., Branch, K., & **Butterfield, A.** (2014). The Ball-In-Tube-Device; A New Approach to Introductory Fluid Dynamics Education. International Journal of Mechanical Engineering Education., AIChE Annual Meeting, Atlanta, GA. 11/2014.

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Branch, K., & **Butterfield, A.** (2014). Analysis of Student Usage on Interactive Simulations. In AIChE Annual Meeting. Atlanta. 11/2014.

Butterfield, A., Le, K.M.Q., Kelly, K., Becnel, T., Gaillardon, P., Citizen Scientists Engagement in Air Quality Measurements, ASEE Annual Conference, Salt Lake City, 2018. 06/25/2018.

Butterfield, A., Kerry Kelly, Katrina Le, Colin Pollard, Keenan Lins, Katie Nolan, Piper Stevens, Vaishnathi Thiraviyarajah, Annika Young and Emma Dean, Building Block Air Quality Sensors, 2017 AIChE Annual Meeting, Minneapolis, Mn. 10/31/2017.

Branch, K.; **Butterfield, A.**; Development and Usage of an Online Homework System in a Chemical Engineering Curriculum; 2017 ASEE Annual Conference, Columbus Oh. 06/27/2017.

Butterfield, A., Branch, K., 464295 Freshmen As Employees on Senior Capstone Laboratory Projects, AIChE Annual Meeting, San Francisco. 11/16/2016.

Kyle Branch, **Butterfield, A.**, 469807 Creation of Low-Cost Spectrophotometers for Use By Students, AIChE Annual Meeting, San Francisco. 11/15/2016.

Butterfield, A., Stephanie Farrell, 473874 Steps Toward Improving the Experience of Lgbtq Students in Our Chemical Engineering Departments, AIChE Annual Meeting, San Francisco. 11/14/2016.

Branch, K., **Butterfield, A.**, "Implementation and Usage of an Online Environment in a Chemical Engineering Curriculum." ASEE Annual Conference, New Orleans. 06/2016.

Butterfield, A., Branch, K., Collaboration between Seniors & Freshmen on Senior Capstone Projects. ASEE Annual Meeting, New Orleans. 06/2016.

Butterfield A., K. Branch, "Results & Lessons Learned from a Chemical Engineering Freshman Design Laboratory", ASEE Annual Conference and Exposition. 06/2015.

Branch K., **Butterfield, A.**, "Analysis of Student Interactions with Browser-Based Interactive Simulations Analysis of Student Interactions with Browser-Based Interactive Simulations", ASEE Annual Conference and Exposition. 06/2015.

Butterfield, A., "Photobioreactor Design & Algae Biodiesel Production Teaching Module", AIChE Annual Meeting, San Francisco. 11/2013.

Butterfield, A., "Use of Arduino Microcontrollers in Chemical Engineering Curricula," AIChE Annual Meeting, San Francisco. 11/2013.

Butterfield, A., "Results From a First-Year Chemical Engineering Design Laboratory", AIChE Annual Meeting, San Francisco. 11/2013.

Branch, K., **Butterfield, A.**, "Teaching Process Design Through Alginate Bead Synthesis", AIChE Annual Meeting, San Francisco. 11/2013.

Butterfield, A., "Design & Assembly of a Freshman Design Laboratory," AICHE Annual Meeting, Pittsburgh, 2012. 10/31/2012.

Young, C., Elmadhoun, A., **Butterfield, A.**, "Hands-On Chemical Engineering Demonstrations for Effective K-12 Outreach," AICHE Annual Meeting, Pittsburgh, 2012. 10/31/2012.

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Elmadhoun, A., Young, C., **Butterfield, A.**, "Student Recruitment and Community Outreach Through an Undergraduate Mentoring Program," AIChE Annual Meeting, Pittsburgh. 10/31/2012.

Butterfield, A., "Browser-Based Simulations for the Illustration of Chemical Engineering Concepts," AIChE Annual Meeting, Minneapolis, 2011. 10/20/2011.

Butterfield, A., "Using Real and Imaginary Pedagogical Parts to Demonstrate Fluid Dynamics and Control Concepts," AIChE Annual Meeting, Minneapolis, 2011. 10/18/2011.

Praveena, P., **Butterfield, A.**, and Skliar, M., Temperature Response of Poly (L-lactide-co-ethylene glycol) Stabilized Perfluoropentane Micro-Droplets, AIChE Annual Meeting, Salt Lake City, UT, 2010. 11/2010.

Butterfield, A., Online Simulations for the Demonstrations of Proper Experimental Design and Data Analysis, AIChE Annual Meeting, Salt Lake City, UT, 2010. 11/2010.

Butterfield, A., Mohan, P., and Skliar, M., Pressure Effects On Bubble Growth in An Emulsion of Surfactant-Stabilized Perfluoropentane Micro-Droplets, AIChE Annual Meeting, Salt Lake City, UT, 2010. 11/2010.

Butterfield, A., An Effective and Economical Photometer for Classroom Demonstrations and Laboratory Use, AIChE Annual Meeting, Salt Lake City, UT, 2010. 11/2010.

Invited Talks

Butterfield, A., *Manageable Teaching and Service Cheat Codes for Young Faculty*, Young Faculty Forum (Invited Talks), AIChE Annual Conference, Presented Online. Invited Talk/Keynote, 11/19/2020.

Butterfield, A., *Off-Road Professing: Creating Positive Change in Curriculum and Department Culture from Outside the Tenure Track*. Education Division Award Winners: Talks and Panel Discussion (Invited Talks), Invited Talk as the winner of the 2017 Award for Innovation in Chemical Engineering Education. 2018 AIChE Annual Meeting, Pittsburgh, Pa., 10/30/2018.

Butterfield, A., *LGBTQIA Students in STEM fields*. American Physical Society, DFD Meeting, All the Faces of Fluid Dynamics Lunch. Invited Talk, 11/19/2017.

Farrell, S., **Butterfield, A.**, "Safe Zone Workshop (Invited Talks)." 2016 AIChE Annual Meeting, San Francisco, Ca. 11/15/2016.

Workshops & Panels

Farrell, S., **Butterfield, A.**, Rivera-Jimenez, S., "Workshop: Inclusive Pedagogy," 2020 AIChE Annual Meeting, Presented Online. 11/19/2020.

Butterfield, A., Peyton, S., Marquez, I., Danielsen, S., Haughton, E., "LGBTQ+ YP Panel," 2020 AIChE Annual Meeting, Presented Online. 11/15/2020.

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Butterfield, A., Farrell, S., Gibson, G., McCormick, A., "LGBTQ+ Inclusion in Engineering: Young Professionals Panel," 2020 AIChE Annual Meeting, Presented Online. 11/16/2020.

Butterfield, A., Farrell, S., "LGBTQ+ & Allies Safe Zone Workshop," 2020 AIChE Annual Meeting, Presented Online. 11/16/2020.

Butterfield, A., "Young Faculty Forum (Invited Talks)" 2020 AIChE Annual Meeting, Presented Online. 11/19/2020.

Butterfield, A., Branch, K. "Using Microcontrollers to Improve Learning and Engagement in Chemical Engineering Classrooms," Invited AIChE Archived Education Division Webinar. 11/08/2017.

Farrell, S., Gibson, G., **Butterfield, A.**, "LGBTQ+ Inclusion in Engineering," 2019 AIChE Annual Meeting, Orlando, FL. 11/12/2019.

Butterfield, A., Farrell, S., Gibson, G., "The Current State of STEM Inclusion in the Workplace," 2019 AIChE Annual Meeting, Orlando, FL. 11/12/2019.

Farrell, S., **Butterfield, A.**, "Workshop & Training on Being a Better Ally of LGBTQ+ Engineers," 2018 AIChE Annual Meeting, Pittsburgh, Pa. 10/30/2018.

Butterfield, A., Branch, K., "Using Microcontrollers in Your Classroom or Laboratory," ASEE Chemical Engineering Summer School, 06/2017.

Butterfield, A., Branch, K., "Safe Zone LGBTQ+ Ally Training Level 1 & 2," ASEE Chemical Engineering Summer School, 06/2017.

Intellectual Property

Ultrasonic Temperature Measurement Device (#9,212,956). Status: Issued. Inventors: Mikhail Skliar, Kevin J. Whitty, **Anthony Butterfield**. File date 08/05/2014; Issue date 12/15/2015. Assignee: The University of Utah. Country: United States.

Periodic Symmetry Defined Bioreactors (US20150299633A1). Inventors: Leonard F. Pease, Swomitra K. Mohanty, John D. McLennan, **Anthony Butterfield**, Tyler Lee, Samuel Doane, Rete Browning. File date 02/18/2014. Assignee: The University of Utah. Country: United States.

Media Exposure

- Young citizen scientists assist in Salt Lake City air quality research. Air quality outreach work highlighted by the National Science Foundation with a 4+ minute video on NSF's social media accounts and on NSF.gov homepage. 03/19/2019
- The air we breathe; pollutants in our own home: New Univ. of Utah study reveals indoor air quality can be as bad as outdoor air. ABC News. 05/09/2019
- Air Products' Donation Advances AIChE's LGBTQ+ & Allies Endowment, AIChE LGBTQ+ and Allies initiative video. A video produced by the American Institute of Chemical Engineers, promoted on their homepage and on their YouTube channel.
- AIChE, Doing a World of Good Podcast Series. 09/19/2018

- Cheap, Portable Sensor Are Democratizing Air-Quality Data, Wired, Jason Plautz. 07/11/2018
- Tony Butterfield: Featured LGBTQ ChemE Professional, American Institute of Chemical Engineers. 02/16/2017
- Utah students get education in air quality by making monitors. Associated Press. 02/13/2017
- Kids Get Hands-on Education in Air Quality. US News and World Report. 02/12/2017
- Students get education in air quality by making monitors. West Plains Daily. 02/12/2017
- Air Quality Sensors, Fox 13 News. 02/07/2017
- East High students create toy-block sensors to detect pollution, KSL, Deseret News. 02/07/2017
- Freshmen and Seniors Team Up, Go to Work, PE, Magazine for Professional Engineers. 01/2017
- U of U students win 'Chem-E-Car' contest with hydrogen-powered vehicle. 11/23/2014 <https://fox13now.com/2014/11/23/u-of-u-students-win-chem-e-car-contest-with-hydrogen-powered-vehicle/>
- Hydrogen fuel pushes University of Utah boxcar into first place at chemical engineering competition By MICHAEL MCFALL | The Salt Lake Tribune. 11/16/2014
- Event at U of U hopes to inspire young engineers POSTED 8:19 PM, OCTOBER 12, 2014, BY FOX 13 NEWS. 10/12/2014 <https://fox13now.com/2014/10/12/event-at-u-of-u-hopes-to-inspire-young-engineers/>
- "Bay Area High School Students Experience Chemical Engineering at AIChE Annual Meeting" AIChE ChEnected. 11/14/2013 <https://www.aiche.org/chenedected/2013/11/bay-area-high-school-students-experience-chemical-engineering-aiche-annual-meeting>
- Gummi Bear Explosion: Candy Immolates When Mixed With Potassium Chlorate, Huffington Post . 06/28/2012. https://www.huffpost.com/entry/gummi-bear-explosion-cand_n_1631010?view=print&comm_ref=false

Professional Organizations

- *American Institute of Chemical Engineers (AIChE)*
- *American Society of Engineering Education (ASEE)*
- *National Organization of Gay & Lesbian Scientists & Technical Professionals (NOGLSTP)*
- *National Science Teachers Association (NSTA)*

Skills

Computer:

- Python
 - CircuitPython
- MATLAB
- C++
 - Arduinos
- HTML, CSS
- JavaScript
- PHP
- SQL
- Fortran
- MS Office
- Adobe Creative Suite
- Fusion 360

Anthony E. Butterfield

Laboratory:

- UV-Vis
- FTIR
- Flame-AA
- SEM
- AFM
- UTM (Instron)
- DSC
- HPLC
- Gas Chromatography
- Refractometry
- Machining
- 3D Printing
 - FDM
 - SLA
- Laser Cutting