
LSU ChemDemo Program

The LSU *ChemDemo* program currently involves various sections of our introductory chemistry courses (General Chemistry 1201/1202; Honors: General Chemistry 1421/1422; Analytical Chemistry 2001, Organic Chemistry 2261) and a couple of upper level courses (Organometallics 4571; Inorganic Chemistry 4570). Interested faculty members who teach sections of these courses assign a bonus (or required for smaller classes) homework assignment to the class. This involves LSU students visiting a K-12 school and teaching a 45-50 minute class on a thematic set of chemistry and science concepts that are backed-up with exciting hands-on demonstrations to illustrate those concepts at an age-appropriate level. We currently have eight sets of tested, safe demonstrations for the LSU students to choose from that usually involve hands-on participation of some or all of the students in the classroom that is being visited. We provide detailed instructions for each set of experiments that includes a list of chemicals and items needed, how to perform and explain the science behind the demonstration, presentation tips, and connections of the chemistry/science involved to everyday life.

The *ChemDemo* Program was initiated by Prof. George Stanley in the Fall of 1997. The following list outlines the participation in this program:

Semester, Year	# LSU Students	# K-12 Classrooms	Professors Involved
Fall, 1997	229	110	Stanley, Limbach
Spring, 1998	267	103	Nauman
Fall, 1998	302	153	Lyon, Nauman, Stanley
Fall, 1999	233	121	Limbach, Stanley
Spring, 2000	146	71	Kolniak
Summer, 2000	55	18	Kolniak
Fall, 2000	240	108	Kolniak, Maverick
Spring, 2001	420	202	Kolniak, Stanley
Summer, 2001	71	23	Kolniak
Fall, 2001	332	139	Kolniak, Stanley, Hammer
Spring, 2002	312	138	Kolniak, Stanley, Hammer
Summer, 2002	76	25	Kolniak
Fall, 2002	162	85	Kolniak
Spring, 2003	425	248	Kolniak, Stanley
Summer, 2003	84	32	Kolniak
Fall, 2003	225	102	Kolniak, Maverick
Spring, 2004	385	176	Kolniak, Stanley
Summer, 2004	96	36	Kolniak
Fall, 2004	394	215	Kolniak, Stanley
Spring, 2005	310	205	Kolniak, Stanley
Summer, 2005	89	42	Kolniak
Fall, 2005	196	92	Kolniak, Stanley, Schmidt
Spring, 2006	301	143	Kolniak, Stanley, Schmidt
Fall, 2006	141	98	Kolniak, Stanley, Garno
Spring, 2007	209	142	Kolniak, Stanley
Fall, 2007	171	77	Kolniak
Spring, 2008	280	151	Kolniak, Stanley, Butler
Fall, 2008	239	133	Kolniak, Stanley, Garno
Spring, 2009	222	170	Kolniak, Stanley
Fall, 2009	191	89	Kolniak, Garno
Spring, 2010	359	169	Kolniak, Stanley
Fall, 2010	394	248	Kolniak, Nesterov, Stanley
Spring, 2011	576	321	Kolniak, Nesterov, Stanley
Fall, 2011	572	332	Kolniak, Nesterov, Stanley
Spring, 2012	444	207	Kolniak, Stanley
Fall, 2012	647	274	Kolniak, Nesterov, Maverick, Stanley
Spring, 2013	635	217	Kolniak, Stanley
Fall, 2013	916	383	Kolniak, Stanley, Nesterov, Garno
Spring, 2014	821	291	Kolniak, Stanley, Schneider

Fall, 2014	830	375	Kolniak, Maverick, Nesterov, Kizilkaya, Schneider, Stanley
Spring, 2015	785	311	Kolniak, Stanley, Magut
Fall, 2015	887	405	Kolniak, Stanley, Nesterov, Kizilkaya
Spring, 2016	276	142	Villalpando, Kizilkaya, Stanley
Fall, 2016	156	100	Nesterov
Spring, 2017	148	72	Stanley, Lopata, Kumar
Fall, 2017			Stanley, Kumar, Nesterov, Lopata, Kuroda
Totals:	15249	7294	

Since Fall, 1997 we have sent out **15,249** LSU undergraduates who taught in **7,294** classrooms impacting over **182,000** K-12 students. This is the largest K-12 outreach/service-learning activity in the United States that we know of. As part of these *ChemDemo* classroom visits, we obtain evaluations from the K-12 teachers about how well the LSU students did with their demonstrations. Virtually all the LSU students received the maximum possible ranking and in the comment section of the evaluation the K-12 teachers *raved* about the *ChemDemo* program. We also have the LSU students write a 2-4 page essay about their classroom experience. Many of these essays contain vivid descriptions of how amazed the LSU students were at performing chemistry (and science) demonstrations in front of a class and how eager, excited, and enthusiastic the students in the classroom were.

We usually recommend that two LSU students visit a K-12 classroom to perform the demonstrations, although as few as one or as many as six students have visited classrooms in the past. When more than 2 students visit a classroom we recommend that they perform demos for enough classes at that school to approximately equal one class for every two students. The LSU students are expected to purchase or obtain some (or most) of the supplies needed for the demonstration (glue, bowls, water, simple containers, paper towels, etc.). The LSU Chemistry Department provides the more specialized supplies and chemicals (like liquid nitrogen, dry ice, chemiluminescent glowsticks, Tesla coils, etc.). Having the college students provide most of the more common supplies needed for the demo makes the program quite cost efficient and considerably less burdensome to administer.

External support for ChemDemo has been increasing with donations from the Albemarle Foundation (\$2,000/yr for 2011-present), the Baton Rouge local section of the American Chemical Society (\$2,000/yr since 2010, extra \$1,000 for 2016), Dow Chemical (\$2,000 for 2015 & 2016; \$2,500 for 2017), and ExxonMobil (\$3,000 for 2015, \$2,173 for 2017). BASF and the LSU *Cain Center for STEM Literacy* have also supported ChemDemo via financial support (\$2,000 from Cain Center) or donations of specialty materials (urethane foam ingredients from BASF). For 2011-12 a one-year \$130,000 grant from the Louisiana Board of Regents awarded to LSU CxC and CCELL attempted to expand ChemDemo to a more general ScienceDEMO program. This involved Geology and additional sections in Chemistry.

A summary of most of the current experiments:

Grade	General Topic/Demonstrations
K-12	The Atmosphere: Liquid Nitrogen (LN₂), Liquid Oxygen (LO₂), Solid CO₂ (dry ice), & Water Vapor This experiment involves using LN ₂ to let the students “see” the major components in the air around us. LN ₂ has a temperature of –196°C and freezing and shattering a flower is always impressive. Dipping O ₂ -filled transparent balloons into LN ₂ caused light blue liquid O ₂ to form and the balloon to completely collapse (& refill on warming). CO ₂ is one of the things we exhale and solid CO ₂ can be dropped in a container of water to make a “witches brew” effect. Having the students blow air into the LN ₂ causes water vapor to condense out making “clouds”.
K-12	Liquid Nitrogen Ice Cream This is a “fun” activity and can be combined with “The Atmosphere” demo to provide a treat for a class.
K-12	Polymer Fun: Disappearing Styrofoam and Starch When Styrofoam is added to acetone (a common organic solvent) it very rapidly dissolves, making it look like it is disappearing. Starch-based packing “peanuts”, on the other hand, will not dissolve in acetone, but do readily dissolve in water. Environmental consequences of these two properties will be discussed with the class. The melted plastic can be recovered from the acetone to make hard styrofoam plastic (illustrating recycling).
K-12	Silly Putty: Synthesizing a Polymer (regular & organic versions) Adding Elmers School glue (or generic brand School Glue) to a water/borax solution causes a chemical reaction between the glue molecules (polyvinylacetate) and the borax molecules (Na ₂ B ₄ O ₇ • 10H ₂ O) to produce a highly flexible, cross-linked polymer. This is similar to silly putty (real silly putty is a polymer based on organosiloxy groups and doesn’t dry out). A hands-on experiment that all students in the class will do.
3-8	Acids & Bases (regular & organic versions) NaHCO ₃ and vinegar is used to shoot a cork out of a bottle demonstrating that some acid-base reactions generate gases like CO ₂ . A voice-activated chemical reaction (speaking into a flask containing base and an indicator that changes color once enough CO ₂ is introduced); pH color changes are illustrated using a basic solution, universal indicator and solid CO ₂ ; the reaction of a metal and acid is shown using Mg and Sprite.
4-12	Energy: Electricity, Heat & Light The properties of electricity are discussed and demonstrated with a Tesla coil and a simple generator allowing the students to turn work into electricity/light. Chemical reactions to make electricity, heat and light are also performed. The ability to convert one form of energy into another is illustrated and discussed.
4-12	Light Producing Chemical Reactions Experiments with “quantum fireballs” (burning metal colors), chemiluminescence, and burning magnesium in dry ice.
6-12	Kinetics, Equilibrium & Catalysis The rates of chemical reactions as a function of temperature will be discussed via the use of light sticks at 3 different temperatures. The concept of activation barriers to chemical reactions is illustrated via the H ₂ /O ₂ balloon explosion. The catalytic decomposition of H ₂ O ₂ and oscillating Iodine reaction are also performed along with the chemical principles involved.
6-12	Stoichiometry is Fun: Bubble Combustion Experiments Stoichiometry concepts are explored by students making soap bubbles using various ratios of O ₂ and combustible gases such as H ₂ , CH ₄ , and CH ₃ CH ₂ CH ₃ (propane) and then igniting them. The loudest “bang” indicates the correct stoichiometry. Overall chemical reactions can be worked out and an unknown gas identified.

Detailed write-ups for the experiments are available from Prof. George Stanley (gstanley@lsu.edu).

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education concentrates

Taking chemistry to Louisiana schoolkids

The ChemDemo outreach program at Louisiana State University, Baton Rouge, brings college students into K-12 classrooms to share the excitement of chemistry. LSU students taking introductory chemistry can volunteer to earn bonus points by visiting a local school to perform chemical demonstrations for students. Chemistry faculty members have prepared detailed instructions for the experiments and supply any specialized materials needed. Second-grade students, for example, might make a Silly Putty-type polymer, whereas older students might delve into kinetics by observing the behavior of light sticks at three different temperatures. About 750 LSU students have visited more than 350 classrooms so far, according to chemistry professor George G. Stanley, who originated the program with associate professor of chemistry Patrick A. Limbach. The demonstrations are a hit with the K-12 students and their teachers, Stanley says, and several LSU students said they've been inspired to choose teaching as a career. The entire program runs on a shoestring, costing less than \$1,000 per year for chemicals and supplies. ◀



Anne Price and Tim Robichaux (not shown) visit Mrs. Bennett's Class at Baker Heights Elementary School in 1997 and have the class make "Silly Putty."



Danny Pino and Jamie Bordelon visit Mrs. Brunson's class at Bernard Terrace in 1997 and have the class make "Silly Putty."



Aggie Domino and Elizabeth McDaniel visit Mrs. Smith's Class at Parkview Baptist Elementary School in 1998 performing Acid-Base Experiments.



Lien Le and Anna Vu visit Mrs. Marino's third grade class at Cedarcrest Elementary School in 1999 and perform the Atmosphere Experiments.



Hollie LeMaire visits Mrs. Leonard's class at Forked Island - East Broussard Elementary School in 1999 to do the Atmosphere Experiments.



Melissa Martello visits Mrs. White's Class at LSU Lab School in 1999 to make "Silly Putty."

LSU Chemistry 1202 Student Demonstration Evaluation Card

1. Your Name & School (please print clearly): Penny D. McDowell Eastside Elem. ✓

2. Did **Joey Plana & George Varnado** visit your classroom and perform a demonstration(s): YES, NO

(cross out the appropriate name(s) if the students indicated above did NOT visit your classroom)

3. Which demo(s) did they perform: acids / bases ① exploding bottle
② Carbon dioxide from voices ③ magnesium dissolved in sprite

4. 30 of their 50 bonus points from this project come from your assessment of their performance in your classroom. How many points do you think they deserve??

0 pts 5 pts 10 pts 15 pts 20 pts 25 pts 30 pts

5. Any comments? I really enjoyed their visit. The students were very excited and interested in the activities. I would like to have more students bring new ideas into my classroom.

LSU Chemistry 1202 Student Demonstration Evaluation Card

1. Your Name & School (please print clearly): Karen Levy St. George School
Kindergarten

2. Did **Lisa Ard, Depika Gopu & Asim Siddiqui** visit your classroom and perform a demonstration(s): YES, NO

(cross out the appropriate name(s) if the students indicated above did NOT visit your classroom)

3. Which demo(s) did they perform: several demo's using liquid nitrogen

4. 30 of their 50 bonus points from this project come from your assessment of their performance in your classroom. How many points do you think they deserve??

0 pts 5 pts 10 pts 15 pts 20 pts 25 pts 30 pts

5. Any comments? My class enjoyed the experiments! The following day on a class field trip the parents in attendance talked with me mentioning comments the children had made at home about the experiments. All were excited. I look forward to doing this again.

Karen Levy

LSU Chemistry 1202 Student Demonstration Evaluation Card ✓

- Your Name & School (please print clearly): Stacey Dupre Scotlandville High School
- Did **Daniel Wilkins & Tai Pham** visit your classroom and perform a demonstration(s): YES, NO
(cross out the appropriate name(s) if the students indicated above did NOT visit your classroom)
- Which demo(s) did they perform: The break down of plastics (Styrofoam) with acetone - (Recycling)
- 30 of their 50 bonus points from this project come from your assessment of their performance in your classroom. How many points do you think they deserve??
 0 pts 5 pts 10 pts 15 pts 20 pts 25 pts 30 pts
- Any comments? They did an excellent job with a difficult class. The class they visited is a low level. They were able to capture the students attention and involve them in the demonstration and discussion. I believe that Daniel Wilkins would be an excellent educator if he would choose to go into the field of education.

LSU Chemistry 1202 Student Demonstration Evaluation Card ✓

- Your Name & School (please print clearly): Vickie Mayeux, St. Mary's Assumption, Cottonport, LA
- Did **Sara Bordelon & Leah Gauthier** visit your classroom and perform a demonstration(s): YES, NO
(cross out the appropriate name(s) if the students indicated above did NOT visit your classroom)
- Which demo(s) did they perform: Liquid Nitrogen + Carbon Dioxide - Frozen - Dry Ice - did several experiments
- 30 of their 50 bonus points from this project come from your assessment of their performance in your classroom. How many points do you think they deserve??
 0 pts 5 pts 10 pts 15 pts 20 pts 25 pts 30 pts
- Any comments? I was pleasantly surprised how Sara and Leah were able to bring the experiments down to the children's level. It was obvious they had planned their entire presentation and had thought how to involve the children. I think this is a great idea and any of your students are welcome in my classroom. Other grades would also be receptive,

ChemDemo Student Quotes from Reflection Essays:

“Not only did we learn something new about science, but we got an unforgettable opportunity to teach children.” – Heather Gallmann

“I really had a good time during this project and also learned a lot about chemistry by teaching it to others.” – Misty Rabalais

“It was a fun and exciting project for both the students and me.”
– Aimee Gravois

“We all enjoyed this project and really felt that we have a better understanding of energy now that we have taught others about it.”
– William Saint

“This was an experience I will never forget. The students along with the teachers had a blast, and so did I. It was a lot of fun and the kids seemed to learn a lot.” – Robert Earhart

Some longer quotes from my 2003 Organometallic class:

“The teaching aspect was great, but what blew me away were the kids, the science, and the whole experience. One of the coolest parts of this experience was the subject matter. I get to teach for the Princeton Review, but it isn’t science so I never realized how much fun teaching chemistry could be. This was so surprising to me because chemistry is definitely not my strongest subject and I had lots of concerns that I would have enough mastery over it to handle a classroom full of students.” “All of the students were fully engrossed in the demos and seemed like they didn’t want the class to end. It was great to see them enjoying themselves and actively participating in the lectures.” “I loved every part of it and would recommend it to all of my classmates.”

Michael Goebel (Biological Sciences major; Kinetics, Equilibrium & Catalysis demo for Bishop Sullivan High School, Baton Rouge, LA)

“I really enjoyed this experience and I really liked working with this age group.” “I’ve been thinking about teaching a high school class during my year off, if I don’t get into medical school this year. This experience made me believe that teaching would be a very good experience. I also enjoyed that students were able to test my knowledge of the subject matter. This helped me connect the dots and this improved my confidence that I may make a pretty good teacher.”

Christy Hartmann (Biological Sciences major, Atmosphere Demonstration, Parkview Baptist High School, Baton Rouge, LA).

“Prior to doing this demonstration, I never thought that I could be a teacher. However, when the students asked their teacher if they could schedule the balloon experiment for another day, I became very excited, knowing that I helped these students enjoy chemistry.” “This experience really was enjoyable. I liked that the students seemed truly interested in what I had to say. I would definitely take part in a program of this nature in the future.”

Megan LaRose (Biological Sciences major; Kinetics, Equilibrium & Catalysis demo for Mount Carmel Academy in New Orleans).

“I think that this kind of demo is excellent for students to see. Many people learn better visually than verbally (lectures). Also, it is important to get younger people interested in science and let them see how interesting and fun science can be. This was a fun experience for Christy and for me. We enjoyed being in

front of the class and saw that it would be fun to teach high school chemistry. I am planning on being a middle school science or math teacher, and if I teach science I would like to regularly include demos and experiments so that they can experience this type of science instead of only hearing about it or reading it in their text. Students remember concepts and ideas a lot better when they learn it by hands-on experiences. I know that the students learned from our visit and I know that I made the right decision to teach instead of become an engineer.”

Sarah Marks (Education major; Atmosphere demo for Parkview Baptist Elementary School, Baton Rouge, LA)

“I think that the overall experience was great for both the students and us. I would never have imagined that I would have so much fun teaching others about chemistry. I think that more classes should visit schools because our visit allowed the students to see that science is cool, college students are cool, and the work that they are doing now is not in vain because they will be able to use that knowledge in college if they desire to go.”

Catherine Thomas (Chemistry major; Atmosphere demo + Acid & Bases demo for Episcopal High School, Baton Rouge, LA)

“One student seemed so fascinated by the demonstration that she came up to us afterwards and said that this had helped her make the decision to be a chemistry major in college. This made us all happy. I enjoyed doing the demonstrations for these students very much, because they were all genuinely interested in it, and participated throughout the demonstration. I had a lot of fun.”

Megha Patel (Biological Sciences major; Kinetics, Equilibrium & Catalysis demo for Bishop Sullivan High School, Baton Rouge, LA)

“At the end of the session, we asked the students who thought chemistry was cool before the experiment and about a third raised their hands. We then asked them who thought it was cool after the experiment, and they all raised their hands!” “I liked the silly putty experiment because they were able to be very involved, which may help them to better remember what they learned. And, most importantly, maybe more of them will come to LSU to study chemistry in some way. I was completely amazed by just how bright third and fifth grade students are!”

Katherine Tallant (Agricultural major; Silly Putty experiment at St. Jean Vianney Elementary School, Baton Rouge, LA)

“Overall, this experience was very interesting. I had a lot of fun, and I know the students and teacher enjoyed the Chem Demos. This was a great opportunity not only to show students that chemistry is interesting and that there is logic behind almost everything, but to answer many questions students had about college. We were able to encourage students and tell them about our majors and the many opportunities chemical engineers have today.”

Rebecca Valladares (Chemical Engineering major; Kinetics, Equilibrium & Catalysis demo for Destrehan High School, Destrehan, LA)