Droplet Lab

How the University of South Florida Made Chemistry More Engaging with Affordable Lab Instruments

Executive Summary

Enhancing student engagement has become a growing priority in the undergraduate teaching labs of University of South Florida's (USF) chemistry department. Traditional teaching methods, which heavily relied on theory and observation, left students disconnected from real-world scientific applications.

Seeking to make surface science more engaging and accessible, USF partnered with Droplet Lab to introduce a customized tool specifically designed for undergraduate education. The partnership successfully bridged the gap between theory and practice, giving students direct, hands-on experience with professional-grade experiments and redefining best practices for experiential chemistry education.

About the Client

Part of the top 50 US-based public research universities, The University of South Florida serves over 50,000 diverse students across its three campuses. USF's Department of Chemistry offers a curriculum that integrates classroom learning and lab work. This dual approach gives students hands-on experience that helps prepare them for graduate study and professional careers in research and related fields.

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The Challenge

USF’s chemistry teaching labs for undergraduates navigated a tough hurdle despite its strong academic foundation. The challenge was to make advanced scientific concepts relatable and exciting for undergraduates. This dilemma is common across STEM education, particularly in surface science. For many students, the subject is an abstract topic that was taught largely through lectures and textbook readings. With no real experimental setups, they found the subject either lacklustre or too complex.

Before: Students learned surface science only through lectures and textbooks — no hands-on experiments

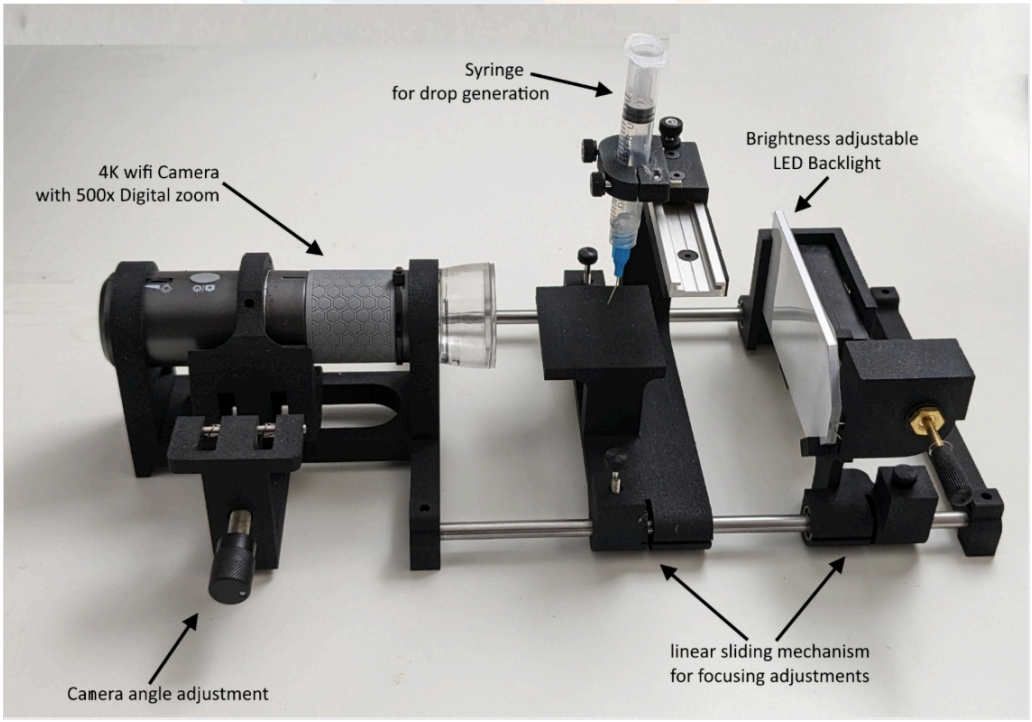
Complicating matters further, commercially available instruments carried price tags that didn’t fit the department's means. The high cost of many laboratory-grade goniometers and related systems effectively restricts access to a select few research students at the graduate level. The university’s chemistry department needed a way to democratize access and bring advanced scientific instrumentation into the hands of large undergraduate cohorts without sacrificing performance.

With these challenges at their back, USF chose Droplet Lab as a partner. Drawn by the company's reputation for creating innovative and affordable scientific solutions, USF chemistry department undergraduate teaching labs picked Droplet Lab for its flexibility and ability to customize systems to specific client needs.

The Solution

Droplet Lab understood early on that adapting an existing product would not be enough to meet USF's needs. Instead, they set out to design a new instrument from the ground up that could deliver reliable performance, hold up to frequent use, and stay affordable for large-scale undergraduate labs, all without compromising scientific accuracy.

Adapted from their flagship system Dropometer, Droplet Lab's professional-grade goniometer system, the Droplet Lab team worked closely with the department's undergraduate labs to develop a sleek surface science instrument tailored purposely for undergraduate labs.



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Smartphones introduced too much variability and maintenance complexity, so the team replaced mobile capture with a simple, robust camera system paired with a desktop computer for processing and analysis.

The design team worked to create an instrument that could withstand heavy classroom use, feature an intuitive UI, and allow for basic maintenance by university staff. Materials and components were carefully selected to keep costs under the $1,000 per-unit budget cap.

The Implementation

Once the design was finalized, Droplet Lab's hardware engineer and software teams led the production and integration process. Dr. Jhon, USF's Assistant Director of Undergraduate Laboratories, got direct feedback at every stage. Over a three-month development timeline, both teams worked closely to prototype, assess, and refine the instrument.

The system's transition into the undergraduate teaching labs was completed within an additional month, overcoming minor logistical roadblocks tied to university-wide technology upgrades. By the end of the implementation phase, the university had purchased 33 customized kits for approximately $30,000, drastically improving the student-to-instrument ratio.

Moreover, the instruments were designed with modular, easily replaceable parts, enabling the department to handle maintenance in-house. This design approach helped ensure investment longevity and minimized future operating costs.

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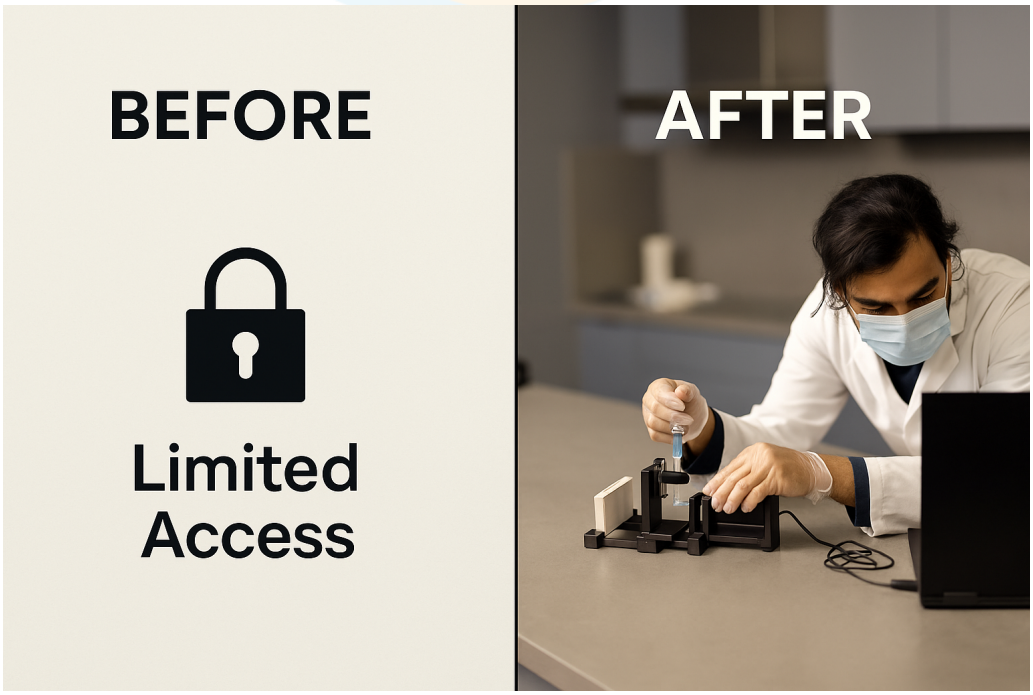
The Results

The partnership delivered immediate, measurable benefits for USF's undergraduate chemistry program:

- **Hands-on access to professional tools**: For many students, this was their first opportunity to directly explore surface science using lab-grade equipment. Affordable instruments reduced competition for resources and improved the student-to-instrument ratio, enabling deeper experimentation.
- **Stronger learning outcomes and confidence**: Based on informal feedback, students produced accurate results, analyzed their own data, and formed independent conclusions about material wettability. Their ability to freely explore the device deepened understanding and boosted confidence in experimental techniques.
- **Support for long-term STEM success**: The department sees this initiative as a way to keep students engaged in STEM, strengthen research skills, and better prepare them for advanced study or careers.



The collaboration between Droplet Lab and USF shows how innovative, affordable solutions can expand access to hands-on learning in science education.

"The willingness of Droplet Lab to create something specifically for academia was fantastic—it shows the company's commitment to supporting educational needs."

Jhon Figueroa
Assistant Director of Undergraduate Laboratories

Conclusion and Future Outlook

Working closely together, the USF chemistry department undergraduate teaching labs and Droplet Lab created a practical, affordable way to bring surface science into undergraduate classrooms. Their collaboration removed a major cost barrier, giving more students the chance to learn through direct, hands-on experiments that connect theory with real-world application.

Positive student feedback is influencing how instructors design labs, with growing emphasis on student-led discovery. The department is exploring more open-ended formats that encourage problem-solving and independent data interpretation, reinforcing a shift toward experiential learning.

As universities look for new ways to make STEM education more accessible and engaging, partnerships like this offer a model for building stronger, more inclusive learning environments that truly prepare students for future opportunities.