

**FOR IMMEDIATE RELEASE****City Tech Chemistry Professor Creates Innovative Tool for Distance Learning Being Used at Educational Institutions Across the U.S.**

Brooklyn, NY — March 21, 2023 — [New York City College of Technology \(City Tech, CUNY\)](https://www.citytech.cuny.edu/) Associate Professor of [Chemistry](#), [Dr. Jay Deiner](#), is among a trio of scientists who have invented a tool that provides hands-on instrumentation experiences for students learning at a distance. First piloted in Chemistry courses at City Tech, this purpose-built invention has been adopted for use at Stanford University and Danville Area Community College, and for outreach curriculum development projects at Rice University and the University of Illinois at Urbana -Champaign.

Deiner partnered with two friends and fellow scientists, Sven Kelling (PhD, Physics) in Spain and Klaus Wiehler (EngD, Electrical Engineering) in Germany, to design, build, and manufacture the [Trimontana Spectrometer](#), a low-cost computer-interfaced spectrometer that students can assemble and use anywhere.

The initial inspiration to create the Trimontana Spectrometer was the desire to provide hands-on scientific instrument experience for students learning remotely during the early stages of the pandemic. However, in the process of exploring ways to bring scientific instruments to students, Deiner and his partners became intrigued by the advantages of place-independent hands-on learning. In particular, they saw the possibility of creating an educational experience in which students could truly understand how instruments work by building them from components, exploring design, and programming software. To drive the spectrometer, Deiner and his partners created a kit including custom software and a six-module curriculum of experiments.

The three scientists created the initial prototype for the spectrometer in the summer of 2020 with 3D-printed pieces, hand wiring, and a Raspberry Pi mini-computer interface. Deiner deployed this first iteration of the spectrometer kit at City Tech in the CHEM 3412 - Instrumental Methods of Analysis class he was teaching in fall 2020.

The first time that the spectrometer was utilized in class that fall semester, Dr. Deiner notes that it was very meaningful to experience a shared activity with the students across remote spaces and the isolation of the pandemic. He found that the types of questions students asked in the process of using the spectrometer in remote learning classes mirrored the kinds of questions students would ask in

research experiences. That first semester, the students puzzled independently and collectively over how to assemble a working spectrometer from a package of wires, optical components, and a minicomputer. Dr. Deiner notes that it is particularly valuable for students to engage in place-independent hands-on learning, outside of an instructor-supervised laboratory space, as it prepares them well for the independent inquiry and thought required in many workplace environments.

A student from the fall 2020 class noted that when tackling experimental roadblocks, she learned to stay calm, and use a step-by-step process of observation, analysis, and understanding until the problem was solved. These are exactly the skills of a research scientist.

His students' experiences provided direction for the development of the second-generation product, which incorporated a printed circuit board base plate enabling enhanced spectral quality and reproducibility. City Tech and Stanford University both ran remote Instrumental Methods of Analysis courses using this version of the spectrometer, and these course experiences suggested a third round of design improvements. The third-generation spectrometer kit is now being used by a community college partner of the [NSF Center for Adapting Flaws to Features](#) (CAFF), which is funded through a grant led by PI Christy Landes at Rice University (NSF Award #2124983).

The spectrometer and concept of modular place-independent instrumentation can be used in all science and engineering courses and at all levels from primary school through university. Modular place-independent instrumentation can also be used for field lab applications where timely on-site measurement is critical.

City Tech Provost and Chemical Engineer Pamela Brown says, "Typically, spectrometers are expensive pieces of equipment, accessible only in chemistry labs. The innovative Trimontana Spectrometer is a low-cost option that expands accessibility and creates opportunities for onsite fieldwork and analysis. It also can lead to deeper understanding as students now build, use and troubleshoot the equipment."

Going forward, Deiner and his colleagues hope that the ongoing curriculum development and course deployments convince the science education community that place-independent hands-on learning is not just a solution to pandemic restrictions, but in fact a valuable approach to providing deep learning in science and engineering and expanding educational access.

"Our mission is to enable students to learn anything, everywhere. The pandemic challenged us to design educational experiences that were not tied to physical spaces. In learning how to create hands-on place-independent activities and foster social and community interaction across distance, we met an urgent need. Going forward, the ability to deliver truly excellent place-flexible learning is critical to ensuring that public education fulfills its mission of eliminating barriers to educational access. For those who balance family, a job, and classes, place-flexible learning is the difference between being able to pursue an education and deferring that dream," says Deiner.

Jay Deiner is an Associate Professor of Chemistry (City Tech, CUNY) and co-founder of Trimontana, an educational technology company devoted to enabling place-independent hands-on STEM learning. He earned a BA in Chemistry from Wesleyan University, and a PhD in Chemistry from Harvard University.

Prior to his present appointment, he performed post-doctoral research at Harvard's Derek Bok Center for Teaching and Learning, and at the Chemical Institute of São Carlos, a campus of the University of São Paulo (Brazil). He has also worked as an ink formulation chemist for the Hewlett-Packard corporation. Deiner's present activities balance a strong commitment to undergraduate education and materials research. In the realm of education, he has developed the Directed Self-Inquiry method for teaching scientific writing, and an Instrumental Methods of Analysis course employing the Application-Based Service Learning (ABSL) pedagogy. The ABSL work was part of an NSF funded project led by Nancy Trun at Duquesne University (#1226175). In materials research, Deiner leads projects in inkjet and aerosol jet printing of electrochemical devices for energy conversion and storage funded by the Air Force Research Lab. He also serves on the editorial board of Advanced Engineering Materials.

For more information about the Trimontana Spectrometer kit, visit

<https://trimontana.tech>.

To browse the Trimontana spectrometer's technical operation manual, visit

<https://docs.trimontana.tech>.

To learn more about the NSF Center for Adapting Flaws to Features (CAFF), visit

<https://nsfcaff.org>.

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### **New York City College of Technology**

Founded in 1946, New York City College of Technology (City Tech) is the designated college of technology for the City University of New York (CUNY). City Tech offers 27 associate and 31 baccalaureate innovative, cutting-edge degree programs spanning the technologies of art and design, architecture, biomedical informatics, business, career and technology teacher education, computer systems, engineering, entertainment, health care, hospitality, human services, the law-related professions, and the liberal arts and sciences. Located at the foot of the Brooklyn Bridge in Downtown Brooklyn, City Tech is a national model for industry-aligned education. For more information, visit [www.citytech.cuny.edu](http://www.citytech.cuny.edu).

### **Trimontana**

Trimontana is an educational technology company that enables hands-on STEM learning by developing instrument kits, custom software, and data analysis tools which students can use in any physical setting, even at home (<https://www.trimontana.tech>). Founders Sven Kelling (Ph.D, Physics), Klaus Wiehler (Eng.D., Electrical Engineering), and Jay Deiner (Ph.D., Chemistry) bring together over 50 years of experience in development of scientific instruments, entrepreneurship, and college teaching. Trimontana's first product is a computer-interfaced visible light spectrometer that students assemble from component parts. While Trimontana was founded in response to an urgent need to deliver sophisticated yet cost efficient instruments to remote students, observed improvements in the level of student engagement and depth of learning make it apparent that the kit-based approach to teaching scientific instrumentation and data analysis has value in all course delivery modalities.