Knowledge is power, it is said. Harnessing that power, however, can be a herculean task in these days of constantly streaming internet and information overload.

As mining and mineral professionals, it is all too easy to get focused on a specific corner of one’s work and lose sight of the big picture. Sometimes, we wish to take a step back, perhaps to expand our horizons, get an overview, explore other sectors, gain new insights into our work, or just gather intelligence on the latest technologies.

What if there is a resource that gives you the knowledge you seek in a condensed form? There is such a resource, and it takes the form of a short course.

Short courses can last from half a day to a week. Half-day courses target a specific topic and are often held in conjunction with a conference to facilitate travel, while week-long courses cover a broader spectrum and are generally offered by institutions of higher learning. *Mining Engineering* set out to take a popular four-day short course at the Colorado School of Mines (CSM) and find out for you what to expect.

The Basics

The short course on New Directions in Mineral Processing Fundamentals was held on the CSM campus in Golden, CO, the week of July 16-19, 2019. The course attracted 32 participants from around the world, including Saudi Arabia, Peru, Mexico and Canada as well as Arizona, California, Colorado, Connecticut, Florida, Montana, New Mexico, New York, Pennsylvania and Texas in the United States.

The participants represented a range of experience levels, from new technicians to seasoned directors, and a diversity of industry sectors, including copper mining, phosphate production, aggregates processing, equipment manufacturing, recycling and wastewater treatment.

Joining us were 11 industry-expert lecturers who assisted the four core CSM instructors: Patrick Taylor, who is the George S. Ansell Distinguished Professor of Chemical Metallurgy and director of the Kroll Institute for Extractive Metallurgy; Corby Anderson, the Harrison Western Professor of Metallurgical Engineering; D. Erik Spiller, vice president and principal metallurgist at Tetra Tech as well as research professor at CSM; and Brock O’Kelley, research associate professor at the CSM Kroll Institute, who is retired from 30 years in the rare earth industry as vice president of technology and technology fellow.
Registration was simple and smooth online. The early-registration fee was $1,995, rising to $2,145 after June 1, 2019, and there were discounts for multiple-participant registrations. (In the interest of transparency, I received a 50 percent discount on the early-registration fee as SME’s managing technical editor and Mineral & Metallurgical Processing Division staff liaison.) Besides course tuition and materials, the fee included continental breakfasts daily, lunch on the second day, drinks and snacks during breaks, and a social reception on the first day.

Participants who completed the course received two continuing education credits.

Course description
The course was described as providing information on how newer technologies are influencing mineral processing and “to provide an introduction suitable for those just entering the world of mineral processing, as well as a look to the future as driven by contemporary innovation.” Its stated aim was to provide engineers, scientists, technical sales teams, government agencies personnel and others working in the field, directly or in supporting roles, an overview of important particulate separation unit operations. Because particulate separation is fundamental to most recycling processes, the course also attracted recyclers.

Emphasis was placed on the following unit operations and their application to operations:

- Feed characterization (mineralogy, size, liberation).
- Comminution (size reduction through crushing, grinding, and other processes) for liberation.
- Particulate separation based on particle size, floatability, specific gravity, magnetic susceptibility, conductivity, and other mineral traits.
- Liquid-solid separation.
- Process flowsheets and their control.
- How to know how well a plant is operating.

Day one
We began the course at 8:30 a.m. on a Tuesday morning in a large classroom in Marquez Hall, where all the lectures were held. As SME headquarters is located in Englewood, CO, I live in the greater Denver area and drove from my home to the campus, but course participants from out of town either flew into Denver International Airport or drove in from neighboring states.

Accommodation was available at Table Mountain Inn, which features a Southwestern decor and is within walking distance of Marquez Hall, or at a number of inns, motels and hotels in the vicinity. There were three bed-and-breakfast options and the historic Stage Stop Guest Cottages. Parking was plentiful as summer classes were over for the regular university students.

Taylor started things off with an introduction and lecture on “Basics, Vocabulary and Concepts.” Anderson then took the class through “Characterization of Ores,” followed by Spiller with an “Introduction to Liberation by Comminution.”

After lunch, we heard from the first of the industry-expert lecturers. John Googins of Aggregate & Mining Consultants LLC spoke on “Crushers and Their Capacity,” Phil Thompson of FLSmidth USA Inc. spoke on “Laboratory Testing for Comminution Power Requirements,” and Mark Jorgensen of Jorgensen Engineering & Technical Services LLC then took the floor with “HPGR Technology Settles In, and Fine and Ultrafine Size Reduction.”

As an engineer and journalist, I appreciated the solid number of industry experts that Taylor, Anderson, Spiller and O’Kelley’s vast combined industry influence and outreach were able to bring to this course and offer to course participants. Mining and mineral processing are largely hands-on activities, and experience sometimes speaks differently from theory. Having both together furnishes a richer, more meaningful experience.

The day closed with a reception at 5 p.m. for the participants and lecturers to mingle.

Day two
The second day began at 8:30 a.m. with “Particulate Separations” by Spiller, followed by “Flotation Testing with a Purpose” by Thompson and “Classification and Liquid/Solid Separation” by Spiller and Taylor.
Lunch was provided on day two, but on the other days, lunch was on our own. There were several options on campus and nearby.

After lunch, we heard from Katherine Ray of Molycop Canada with a lively talk on “Making and Using Grinding Media,” Harold Cling and Jordan Rutledge of Tomra Sorting on “Sensor-based Sorting Applied to Ores and Recycling” and Anderson on “Cost Analysis,” ending the day at 5 p.m.

Day three

Spiller got the third day going with “Tailings Management,” a particularly relevant topic in light of several recent catastrophic tailings dam failures. Steve Hearn of Huntsman Corp. then spoke on “The Changing Face of Commercial Flotation.”

After the break, we had a real-time video lecture by Caelen Anderson of Nevada Gold Mines, calling in from the field, on “Advances in Real-World Process Control.” O’Kelley then spoke on “Plant Design and Operations,” Deepak Malhotra of Pro Solv Consulting LLC on “Plant Performance and Audits,” Spiller and Taylor on “Mineral Processing in Recycling,” and Alex Holtzapple of Metatom International on “Geometallurgy: The Metatom Approach.”

After closing discussions, the class adjourned at 5 p.m. But it was not “all work and no play” for this group of course participants. With the long summer days, fine Colorado weather, and outdoor delights of the Rocky Mountains beckoning, one group managed to fit in some whitewater rafting after classes were over, and I know personally of one participant who spent every lunch hour enjoyably fishing. All is aboveboard, however, as he owns his company and answers only to himself.

Day four

The course ended on a Friday with a laboratory tour and demonstrations of most of the unit operations discussed in class, and the presentation of certificates of completion.

We were divided into several groups for the laboratory tour and guided by CSM student volunteers to the pilot and laboratory-scale plants, where more student volunteers operated the plants and explained the workings. Video recordings were allowed, and many a smartphone was whipped out to record each demonstration of a unit operation for posterity.

The CSM instructors had stated that their desired outcome of the course is for participants to gain an understanding of how processes evolve from feed to products. As the course drew to an end, my impression is that they achieved their goal. There was a tremendous amount of information to take in and process, but the course instructors put in the hands of the participants the tools to take the learning process further.

Would I take another short course? Yes, in a heartbeat. As we went on our laboratory tour, my first question to my CSM student guide was whether CSM had a similar short course on new directions in mining fundamentals. The answer is no, but I aim to be on the lookout for one.

The short course on New Directions in Mineral Processing Fundamentals is offered annually by the CSM in July. For more information, email Patrick Taylor at prtaylor@mines.edu.