College Chemistry Canada
La Chimie Collégiale au Canada

Newsletter

VOLUME 44, ISSUE 1 JUNE, 2021

In This Issue

THE 47TH COLLEGE CHEMISTRY CANADA (C3) CONFERENCE, MAY 27-28, 2021 WAS A VIRTUAL EVENT!

For the first time ever, the C3 conference was held as a virtual event over two days (May 27-28) using the Zoom platform. The theme for the conference was **COVID Chemistry education worth Continuing** The conference included an introductory talk by Andy Dicks (University of Toronto), 36 talks in two concurrent sessions, Q&A follow-up sessions, an AGM, the General Student Award presentations and a concluding talk by Yann Brouillette (Dawson College). Over 150 people registered for the conference and there were approximately 120 attendees at any point in time during the conference.

Click on these links to access the Conference Program and the Conference Abstracts. A C3 YouTube channel has been created where you can access videos to most of the talks!

Conference Organizing Committee:

Charles Lucy (U of Alberta, AB), Jimmy Lowe (BCIT, BC), François Gauvin (Université de Saint-Boniface, MB), Yann Brouillette (Dawson College, QC), Kathy Darvesh (Mount Saint Vincent University, NS), and Carl Doige (Okanagan College, BC)

VOLUME 44, ISSUE 1

COLLEGE CHEMISTRY CANADA GENERAL STUDENT AWARDS –2021

Tara Dickie

(dickiet@uleth.ca) University of Lethbridge, Lethbridge, AB

Tara began her academic training as an undergraduate at McMaster University. She is currently completing her Ph.D. in the field of organometallic actinide chemistry at the University of Lethbridge.

In the words of Greg Patenaude, instructor and lab coordinator at the University of Lethbridge, "Tara is an outstanding graduate student and one of the best teaching assistants (TAs) I've had the pleasure to work with. She is conscientious, rigorous, and open minded; all of the traits which will make her successful in the future". As a student, Tara has an impressive track record with her involvement with student organizations and public outreach programs. For example, as president of the McMaster Undergraduate Student Chemistry Society (MUSCS) she attended the local Hamilton CIC chapter meetings in 2013 and 2014. At the University of Lethbridge, she competed in the Chinook Symposium in 2015 and 2016 and in 2017, she participated as a judge. Currently, she is an executive member of the newly formed Graduate Student Chemistry Society at the University of Lethbridge. In addition, she is a current member of the Chemical Institute of Canada (CIC) and attended the Canadian Society of Chemistry (CSC) exhibition and conferences in 2013, 2016, 2017, 2018, and 2019. In 2018, Tara received the Young Investigator Grant to present at the International Conference of the f-Elements , (ICFE10) in Lausanne, Switzerland. She has also recently published a paper in organometallics entitled "Diphosphazide-Supported Trialkyl Thorium(IV) Complex".

As a teaching assistant at the University of Lethbridge, Tara made significant contributions to the improvement of the second semester Organic Chemistry labs. These improvements include: 1) developing support for students to master notebook skills, 2) producing interview protocols as a replacement for the traditional lab reports, 3) developing a completely new lab, with protocols, report guidelines and a report marking guide 4) organizing the teaching laboratory in a new Science building, and 5) developing COVID-19 protocols for running in-person labs during the pandemic.

Post graduation, Tara hopes to get a postdoctoral position researching super heavy elements.

Nick Roberts

(nicholasroberts@dal.ca) Dalhousie University, Halifax, NS

Nick is currently a 3rd year undergraduate student pursuing a Bachelor of Science with a major in Chemistry and a minor in Neuroscience at Dalhousie University. During his first year, Nick joined the Chitnis group, which focuses on main group inorganic chemistry, as a volunteer. By the end of the summer of his first year, he was published with the group in Chemistry: A European Journal. Through this volunteer role, Nick gained extensive training in air sensitive techniques (Schlenk line and glovebox chemistry) during his second year, which led to him getting accepted into the Inorganic Chemistry Exchange (ICE) program at his first-choice placement at Carleton University with NSERC USRA funding. Most recently he has been hired as a full-time student researcher in the Chitnis group.

Outside of his interest in inorganic synthesis, Nick has taken much pride in his teaching at Dalhousie. Nick joined the First Year Chemistry Laboratory Teaching Team, in Fall 2019, where his ongoing commitment to improving his teaching and the student experience, led to his recruitment to the Online Laboratory Development Team in Summer 2020. Within this team, Nick spoke fully of his ideas to improve course content whilst initiating and championing design ideas that ensured the preservation of in-person laboratory hallmarks, such as choice in experimental path, opportunities to make/learn from experimental mistakes, and establishing chemistry community, despite the 2020/2021 fully online laboratory delivery! As a Senior Teaching Assistant (the first undergraduate student to take on this role in the 1st year laboratory), he independently implemented new tutorials into the laboratory program to support students on tricky topics. Nick is currently a co-investigator/grant holder on several teaching research projects. One of these projects was catalyzed by his advocacy for accessible course design with a focus on the implementation of colour deficient supports for students during colour-based observation experiments.

Through his work with the Dalhousie University Undergraduate Chemistry Society (DUUCS), Nick is committed to creating community among undergraduate students, graduate students, and faculty, as well as, providing honest/critical feedback about his experiences as a chemistry student, and ensuring his fellow students are informed of and connected to opportunities to get more involved in chemistry, science and campus life.

Nick's accomplishments in his studies, research, and teaching have been recognized by Dalhousie University, departmentally with the 2020 Spirit of Chemistry Award, the 2020 Chemistry Achievement Award, and the 2021 Undergraduate Student Award for Teaching Excellence in Chemistry, institutionally with the 2021 Educational Leadership Award for Collaborative Teaching, and nationally by the College Chemistry Canada through the 2021 C3 General Student Scholarship.

SUBMITTED ARTICLES

Editor's Note:
This Newsletter is a special edition. It reflects some of the remarkable modifications and innovations taken by chemistry instructors as they adapted to the challenging teaching environment which emerged as a result of the COVID-19 pandemic. The following articles are an extension to the presentations in the C3 47th conference and are testimony to the resilience and care the chemistry education community brings to their vocation.

ONE GOOD THING

Dietmar Kennepohl (dietmark@athabascau.ca), Athabasca University , AB

Teaching chemistry at an open university that is already completely online, I offer a slightly different perspective to chemistry education in COVID times for the newsletter. Many of my colleagues have already heard me present at C3 conferences over the years on teaching chemistry online. This has included using online self-diagnostics, as well as approaches to the laboratory component exploring home-study laboratory kits, computer simulations, and remote-controlled labs.

So last year when most educational jurisdictions outright cancelled all in-person classes and were looking to move to remote learning to temporarily bridge the gap, I thought the whole world had become Athabasca University. Indeed, I was approached by desperate educators from around the globe wanting to immediately convert their courses right in the middle of term. Even with over 25 years of online and distance experience, this was new territory for me. I am used to developing online courses and then running them. Moving over from in-person to remote during the course itself is a bit like trying to change the tire on a car while it is still driving down the highway.

Yet, it got done, because it needed to be done. What have we learned from all this? In the short term, practical lessons like moving the last month of term lectures and assignments online, setting up alternate laboratory experiences, running remote examinations, and hopefully avoiding slapped-on solutions such as long lecture recordings and textbook dumps in the process. Working intensely with colleagues and institutions in one-on-one sessions and through invited webinars this last year, I know the situations are all different. Some were already using online components and so would extend what they were already doing. On the other hand, some could not easily replace advanced in-person laboratory experiences with just an alternate assignment or a simulation and had to make due. While a difficult situation for everyone, I have really been impressed by some of the ingenious and imaginative solutions that have come out of this past year. This issue of the C3 Newsletter highlights some these from across Canada. I also note that The Journal of Chemical Education recently devoted a whole issue to this. They are all worth a look for practical guidance and inspiration.

ONE GOOD THING - continued

As face-to-face becomes possible again, I am hoping that chemistry educators will remember some of that creativity shown during the pandemic and incorporate those alternative remote learning activities in their own courses in future. However, there are also some bigger overarching lessons to be found here. Speaking with many colleagues who have now had a chance to walk a mile in my shoes, many have expressed the change in perspective that goes well beyond just technology. I hear more about their teaching experiences in terms of kindness, increased trust, flexibility, taking more risk, valuing relationships, and closer connections, despite the physical distance. There seems to be a willingness to innovate more, a renewed appreciation of the human connection, and a rekindling of that passion for teaching and learning. For chemistry educators that meaningful self-reflection may be one good thing to come out of the chaos that was 2020.

References

1. Journal of Chemical Education Special Issue on Insights Gained While Teaching Chemistry in the Time of COVID-19. J. Chem. Educ. **2020**, 97(9), 2375-3470.

COMBINING ASYNCHRONOUS LECTURE VIDEOS WITH SYNCHRONOUS MICRO-PEER TEACHING

Tasha Jarisz (tjarisz@uvic.ca), University of Victory, Victoria, BC.

Last year, in the midst of the pandemic, I was asked by faculty at the University of Victoria to teach a third year analytical chemistry course (instrumental techniques of analysis), starting in January of this year. I had never taught a full course at the university before. Not only that, I would be the person responsible for transitioning this course to an online format. I was excited, but I also felt an extraordinary challenge, with a little nervousness.

Then I realized something quite important. This would give me the opportunity as an instructor to design a course that incorporated more active learning, which is something I have always wished to try. I would have this opportunity because the course would be free of the restraints that come with a traditional classroom's physical barriers, where row upon row of stationary seats in lecture halls make it difficult to have students interact with one another. This is especially true for larger classes (mine this term was 84 students). However, being online, I could give my students the flexibility in when and how they consumed lecture material, while also increasing student-to-student interaction.

To take this opportunity afforded by being online, and utilize the advantages, my strategy was to use a mixture of asynchronous lecture videos posted each week to our LMS, as well as synchronous "live learn" sessions on Zoom®. At the beginning of the term, learning how to use new technology to record lecture videos—and spending the time creating them—seemed daunting. However, the benefits far outweighed the extra effort: by having students watch these short videos before class to build their foundational knowledge, it opened up many more opportunities for active learning and engagement *in* the (virtual) classroom. The same benefits could be realized in a physical classroom by continuing to use recorded lecture videos; something I never would have considered before the COVID era of online teaching.

Although I tried various active learning strategies during the weekly live learn sessions, the one I found to be most effective for a fifty minute class, and received the most positive student feedback, was micro-peer teaching. In this context, micro-peer teaching involved small groups of four to five students being assigned a "micro" topic from that week's content—something that could be explained in two minutes or less. I would randomly generate groups using the breakout rooms feature in Zoom®, and students would have fifteen minutes to create a lesson plan and visual aid to teach their topic to the rest of the class. This incentivized coming prepared to the session by watching the lecture videos and completing the assigned reading ahead of time. Back in the main session, each group would take turns teaching their topic in two minutes or less. The small group sizes enabled (1) greater focus on more digestible topics; (2) better quality discussion; and (3) more accountability. I was always thoroughly impressed with the students' creativity. Some used the whiteboard feature to draw diagrams in real time and so the whole group could contribute, others elected a group member to deliver the lesson using PowerPoint or a Google doc containing notes and figures.

COMBINING ASYNCHRONOUS LECTURE VIDEOS - continued

Each groups' lesson was unique and focused only on the key concepts, which encouraged student engagement. An unexpected benefit of the micro-peer teaching was the enhanced student interaction during the presentations; group members would send words of encouragement and support through the chat function, and students from other groups would ask questions or add a piece of information that was missed. Overall, the students delivered accurate, comprehensive, and engaging lessons. If there was a key piece of information that was missing or not conveyed correctly, I would chime in at the end to make sure that everyone understood the concept correctly. This was also a way for students to receive immediate feedback, and correct any misconceptions.

I received positive student feedback on the micro-peer teaching sessions. Students appreciated the variety of engaging presentation styles, the straightforward explanations by their peers, and the ability to participate during class sessions. I intend to adapt a similar strategy for face-to-face instruction, incorporating pre-lecture videos and readings, so that class-time may be devoted to other active learning activities, including micro-peer teaching.

DISCUSSION BORED? & OTHER MUSINGS ON VIRTUAL INTRO ORGO: A FOLLOW-UP

Andy Dicks (andrew.dicks@utoronto.ca), University of Toronto, Toronto, ON

In this article I build upon my opening presentation at the recent C3 conference, where I outlined what "worked" in teaching an online introductory organic class (CHM 247H: 400 second-year undergraduates) during the Winter 2021 semester. Students responded positively to an Ed discussion board (https://edstem.org), short review videos covering prerequisite course material, and a "touch base" Week 2 survey designed to take the temperature of the class. Here I elaborate on other aspects of this course which were tried for the first time with an emphasis on the following: (i) online test "debrief" sessions; (ii) virtual student hours; and (iii) providing class recordings.

As educators we understand the importance of providing timely feedback to students regarding their performance on formal assessments. For many years I have run term test "debrief" sessions during class time: usually about 15 minutes long, with a focus on presenting overall grade statistics and a summary of common errors that students made. The online course environment gave me the idea of holding much longer post-test review sessions (both live via Zoom® and recorded, held during the evening two days after each of the first two term tests). Both sessions were embedded into the course syllabus to assist with student scheduling and were about 90 min. long (the time it took me to cover all of the 17 multiple-choice questions set on each test). Students were able to ask in real time about questions they did not understand, or about solutions that did not make sense to them. This strategy seemed richer than my usual one of simply providing a model answer key! As a student put it in the anonymous post-course evaluations: "I like the exam question review sessions after each exam, which helps me to understand the concepts better." I plan to continue this practice when CHM 247H returns to in-person instruction.

Secondly, I held virtual student hours (out of necessity!) directly after each one-hour class finished (three times a week) and additionally twice a week during the evenings. The post-class hours were extremely popular and ran until nobody remained in the Zoom® meeting, whereas the evening hours typically had between 5 – 20 students in attendance (quite similar to in-person). Unlike face-to-face student hours held in my office, it was clear that the online hours were welcomed by some students who were happy to listen and not actively participate. Some representative student feedback was "I appreciate Dr. Dicks' 8 p.m. office hours as well as it's when I do my homework so I can just hop on to ask questions right away" and "I also really liked how the professors stayed online after class to answer all the questions that students may have." This does not mean that I anticipate completely replacing in-person student hours with online ones though: I foresee a blend of the two types being offered in the future. Our university has a large number of commuter students for which daytime, in-person support is sub-optimal – online, evening options may assist in this regard.

Finally, as was the case at the majority of institutions, classes were recorded along with tutorial sessions that were delivered by graduate student teaching assistants. This was primarily to accommodate the large number of students situated in remote loca-

DISCUSSION BORED? - continued

tions and different time zones (very important during a pandemic!). However, for me, this approach had several pros and cons. The opportunity for students to review material and improve understanding is clearly beneficial, and making recordings available is certainly in the spirit of the Universal Design for Learning principles (http://udlguidelines.cast.org). Conflictingly, it was very noticeable that the live class attendance numbers dropped significantly as the semester progressed, suggesting that more students became reliant on the recordings as a substitute for active, real-time class participation (this was certainly not my intent in providing the recordings!). I am very much undecided about how to best work with recordings in the future: I do think I need to be more transparent about their advantages/disadvantages – and perhaps just provide them for a fixed period of time after each class? To be continued…

ADAPTING TO TEACHING ORGANIC CHEMISTRY ONLINE BY FOCUSING ON RETAINING NORMALCY AND CONNECTIONS WITH THE STUDENTS

Jessie Key (jessie.key@viu.ca), Vancouver Island University, Nanaimo, BC.

Although the suggested theme of this newsletter was to focus on one main change made to overcome challenges teaching during COVID-19, I would argue that the greatest successes teaching organic chemistry at Vancouver Island University (VIU) during COVID arose from the many small changes which focused on retaining normalcy and human connections with our students.

Lecture Delivery – Striving for normalcy:

To retain the feeling of normalcy, lectures were taught synchronously over Zoom during the regularly scheduled class times and recorded for posting on the course learning management system (LMS) to allow for asynchronous viewing. The use of dual monitors (a laptop screen and a 21-inch secondary monitor) allowed for effective presentation of the PowerPoint lecture slides and the monitoring of the chat window for rapid response to student questions. Examples and problem solving were demonstrated using a 25x40 cm whiteboard. To clearly capture the whiteboard a Logitech USB webcam was clamped to a small retort stand to make a document camera. Anecdotal student feedback suggested that many students craved this traditional-feeling synchronous classroom interaction, mentioning 'organic lectures felt like the only time I was actually attending a University class.'

Maintaining connections with students in lecture and the learning management system:

Physical distancing, reduced social interactions, and other restrictions have left many feeling isolated and depressed during COVID-19. Teaching organic chemistry online I have tried to be particularly aware of these additional stresses on the students and make small changes in attempts to bolster the feeling of connection and reduce overall stress levels.

One change came about serendipitously, when my dog Piper was barking in his sleep during a synchronous lecture. My immediate response was to be embarrassed

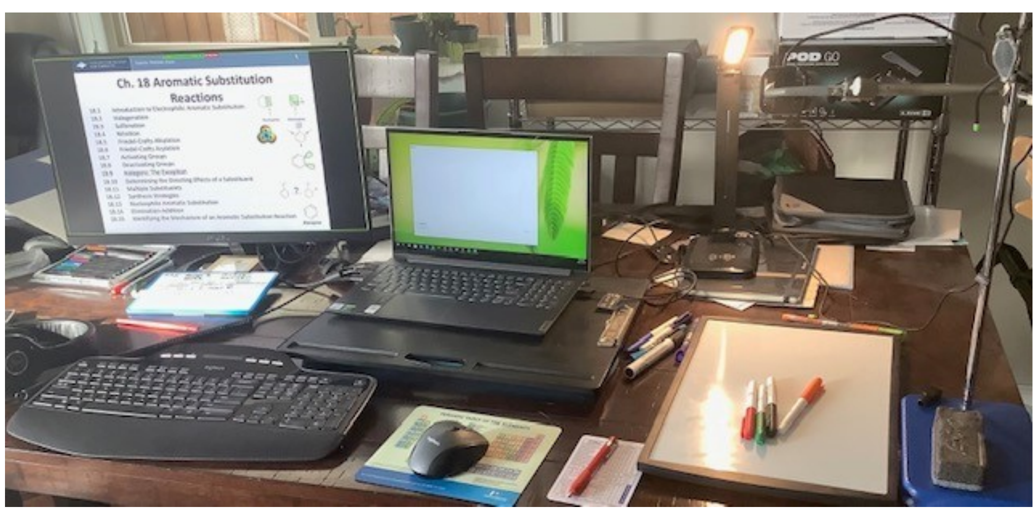

Figure 1. Setup for online teaching: A dual monitor laptop using Zoom with whiteboard and webcam document camera for problem solving.

ADAPTING TO TEACHING ORGANIC CHEMISTRY - continued

and apologize for the disruption to the class. However, many students actually perked up and became more active in the chat window inquiring about the dog and talking to each other about their pets. To boost morale and student engagement, once a week I now start classes with a quick picture of Piper enjoying his best dog life.

Another small change has been to try to answer student emails more quickly. I now make an intentional effort to periodically check my work email a couple times an evening and respond to student questions. Reliable, rapid help for a course is a way to reduce overall student stress levels, take away some of the frustrations adapting to the new challenges of learning and assessing online, and make students feel connected and valued.

My final comment is on something I have been doing for a few years, but I think has become increasingly important teaching online. After each quiz or test is returned to the students, they complete a "Post Assessment Reflection" (PAR) in the form of a short completion quiz on the course learning management system. The sum of all PAR's is worth 2% of their total course grade to incentivize completion. The PAR is simply 6 questions which gets them to think about their own learning and prompts them to ask about topics they are unsure about or would like additional resources for. Responding back to their PARs with explanations or links to additional resources fosters a connection with the students and makes them feel more supported in their learning. I think this is especially important teaching online, as students may feel too shy, embarrassed or alone to actively seek out help.

CASE STUDY TO PROMOTE LAB SAFETY IN THE ONLINE LAB

Kelly Resmer (kelly.resmer@msvu.ca), Mount Saint Vincent University, Halifax, NS.

When chemistry labs moved online there were many conversations about what realistically could be done online. One thing I was very skeptical about was teaching lab safety. How could I communicate the importance of working safely in the lab when we aren't handling any chemicals or glassware? Fortunately, the article "Using a Case Study to Teach Hazard Analysis and Risk Minimization" by Scott R. Goode appeared in the Journal of Chemical Education (2021). This article features a 4-week case study that I modified to fit into one lab session. Before coming to the online lab students viewed the provided video and read the news article (see the supplemental information provided in the article) and were told to arrive to our online session ready to discuss. Given the traumatic nature of the accident a content warning was provided, and an alternative activity was available.

Students were divided into randomly assigned groups to complete the group work activity. I used OneNote to facilitate the group work since it allows for multiple people to edit the document at once and I could view the group contributions in real time to make sure each group was on task. Since first year chemistry lab students come from a variety of previous educational backgrounds doing this task as a small group allowed those unfamiliar with lab experiments to be guided by those with more lab experience. Students completed a RAMP analysis of the chemistry demonstration. Then created a new experimental procedure to reduce hazards, describe safety equipment needed, how to respond to emergencies and listed step by step how to carry out the experiment safely.

As usual, WHMIS training was mandatory this term, safety data sheets were studied and provided for each experiment, even though chemicals were only handled virtually. After completing these safety activities students were quick to point out safety violations in the YouTube videos, we watched for experimental lab procedures. Lab report questions asked students to point out unsafe lab practices and students could always point these out with ease – even without entering the chemistry lab! At the end of term students designed their own lab experiment and one component was to describe hazards and risks with the experiment and what safety practices to follow. This component was completed by all students. The case study helped set the importance of lab safety tone for the term; I plan to continue using this case study approach to promote lab safety even once we return to in-person lab learning. Complete reference to case study:

Using a Case Study to Teach Hazard Analysis and Risk Minimization Scott R. Goode *Journal of Chemical Education* **2021** *98* (1), 183-185 DOI: 10.1021/acs.jchemed.0c00127

COVID CHEMISTRY EDUCATION WORTH CONTINUING - A VIEW FROM THE OTHER PART OF THE WORLD

Thilini P. Rupasinghe (thilinir@kln.ac.lk), University of Kelaniya, Sri Lanka

It is a well understood fact that the global pandemic Covid-19 led to a rapid paradigm shift in the entire global education system from the traditional teaching and learning with physical interactions towards digital learning in distance mode. Initially in early 2020, when the pandemic started and all the countries in the world moved with national closures of schools/universities, majority of the educators and learners across the world had to face several challenges as this was an unplanned, emergency shift towards online teaching in which, delivering content and evaluating students understanding was solely done using technology. However, during the last 18 months, educators have come up with remarkable innovations in terms of teaching and learning practices, indicating that every dark cloud has a silver line. And, such advances can be continued in the future enabling educators to provide meaningful and quality education for learners worldwide.

Chemistry teaching encompasses theoretical classes and laboratory classes and both of these components had to be conducted virtually after the university closure. Conducting laboratory classes was a huge challenge for chemistry educators. The main objective of chemistry laboratory classes is to provide hands on experience and opportunity to explore methods used by chemists in the real world. However, providing such learning experience virtually is a challenge. Despite the challenges, chemistry educators have developed several virtual laboratories such as PHET, OLABS and Chem Collective and they were able to provide the "real" laboratory experience to learners up to a certain level. Although, these virtual laboratory resources were available for quite a long time, the use of such virtual lab resources by chemistry educators was limited to educators from certain countries, in which the field of chemistry education has received significant recognition and appreciation. In fact, such approaches were solely a brand-new experience for the chemistry educators from certain parts of the world (especially from the developing countries), owing to access, awareness and experience issues. However, due to the pandemic, virtual laboratories became popular and the chemistry educators all over the world had to utilize virtual laboratories. Further, many organizations made these resources available for educators free of charge during the pandemic, providing more access. More importantly, this was an eye opener for traditional teachers to rethink about their teaching approaches, which was an indirect benefit of this unexpected pandemic. And, in the future once the laboratory classes are shifted back to the face–to-face mode, these will continue to be used as pre-lab activities to be done before actual laboratory classes. Further, it will allow students obtain a comprehensive understanding on what they will be doing in the physical laboratory sessions, as most of the laboratory classes are still conducted in recipe style. Moreover, if carefully planned, these can also be used as pre-activities to invoke students' interest and motivation, before laboratory sessions or theoretical classes.

Another key area in chemistry education that has been advanced during this pandemic era is assessment and evaluation. Due to the difficulties in implementation, educators had to move forward with non-traditional assessment methods in the virtual teaching mode. With the dedication and creativity of several teachers, novel and innovative assessment approaches such as student-led video production, scenario based assessments, home based projects, etc have been developed, providing a remarkable learning experience to students. In the future, these can be continued in the regular classrooms as formative assessments to support students leaning and provide meaningful feedback.

Moreover, the use of online Learning Management Systems (LMS) were not much popular in the several parts of the world (especially in developing countries) due to availability, experience and resource issues and the teachers & students didn't have any experience in using them. But with this emergency shift to virtual teaching, now students and the teachers have successfully utilized them and have become familiar with the use of LMS. Teachers can use the LMS to upload lecture materials, online resources like e-books, web sites etc and that provides students with more access to teaching materials where interested and motivated students can get the use of it. Further, LMS can be used to provide feedback through forum discussions, etc as the classroom time is limited.

Further, the experienced gained during this pandemic has opened several new avenues in the field of chemistry education such as blended learning, especially in the communities in which these concepts were not much popular. With the recent familiarity of LMS and online teaching of teachers, we can move towards the concepts of flipped classroom and blended learning, where content information is done through the LMS and the practice part is done in the face-to-face setting which is highly

A VIEW FROM THE OTHER PART OF THE WORLD - continued

effective for settings with limited resources and time.

Over all, this paradigm shift from the traditional face-to-face teaching to virtual teaching during the Covid-19 pandemic has opened several new avenues in the field of chemistry education, especially in the countries in which traditional teaching approaches were in practice. And, the future learners will definitely be benefitted from these novel teaching innovations if they are continued in the post-pandemic era.

CHEMISTRY EDUCATION DURING COVID TIMES – THE UNIVERSITÉ DE SAINT-BONIFACE FIRST-YEAR “LABORATORY” EXPERIENCE

François Gauvin (fgauvin@ustboniface.ca) Université de Saint-Boniface, Winnipeg, MB

Like many institutions in Canada, the *Université de Saint-Boniface* (USB) implemented a number of measures in 2020-2021 to ensure proper theoretical and practical trainings during COVID-19 pandemic. All theoretical courses were online and a number of in-person science and nursing practical activities were held on campus with applications of strict sanitary procedures to keep everybody safe (students, teachers and staff).

This short article describes my first-year laboratory teaching experience at USB in 2020-2021. Last year, our general chemistry courses were CHEM 1301 (in Fall term) and CHEM 1311 (in Winter term); each one involving a laboratory program that counted for 20% of the student’s grade. Beginning in 2021-2022, all first-year laboratory components will be merged into a single new 3-credit Laboratory Course, CHEM 1121, which will be offered in fall and winter terms (thus allowing sections of smaller sizes).

In-person Laboratory Programs: Health and Safety First

Potential employers always value the technical abilities of our students in their workplaces. This is the major reason why we wanted to hold the minimum number of in-person practical activities on our campus that would still enable students to acquire the necessary lab skills. Naturally, health and safety of students, teaching colleagues and university staff remained a priority for us. Therefore, for each of our laboratory programs, we determined the essential skills students needed to master in order to receive proper training. For our first-year laboratory programs, I decided to put the emphasis on the following knowledge and skills during the 2020-2021 academic year:

- Mass, volume and temperature measurements;
- Crystallisation and Filtration techniques;
- Heating techniques and constant volume calorimetry;
- Acid-base and complexometric titrations; and
- pH measurements.

Currently, our chemistry laboratory rooms have a total capacity of 32 students and are used for three different sets of courses: first-year, organic, and biochemistry. Typical enrollment in a first-year USB chemistry class is around 60 students. The latter are distributed into two 30-student laboratory sections per term. In order to ensure proper physical distancing between lab occupants, each 30-student section was divided into three 10-student groups in the Fall term. These students came to perform labs on campus every three weeks. Under these conditions, experiments were carefully chosen to cover the essential knowledge and technical skills mentioned above. Overall, three experiments were performed in the fall and four in the winter (the Winter CHEM 1311 group was smaller than the Fall CHEM 1301).

Prior to coming to their first laboratory session, students had to follow our in-house “GHS/WHMIS 2015 & Lab Safety” online

THE USB FIRST-YEAR "LABORATORY" EXPERIENCE - continued

training. Then, according to their schedule (and 3 hours or less before each lab session), students had to answer a COVID-19 screening survey via our Learning Management System (LMS) eCampus/Moodle. They were then instructed to come to campus at least 10 -15 minutes in advance. Students had to wait outside the building until I opened the doors for them. Upon entering the building, additional screening questions were asked and then everybody was escorted to the lab via a specific path to minimize risks of contact with other people. Doing so, we also went through an intermediate room where students could leave their personal belongings in a secure place. At the lab door, student's temperature was taken using a ULINE infrared forehead thermometer (model H-8862). Inside the lab, a DENT-X disposable procedure face mask was made available to each student; everyone in the lab (students, assistant and prof) was wearing the same kind of mask during the lab session. Naturally, everyone was also wearing lab coat and safety glasses.

For the first-year chemistry and biochemistry labs, individual workstations were located on the benches (and in two fumehoods) as shown in Figure 1 to ensure the proper 2-m distance between students and minimize their displacements in the lab. A total of 10 workstations were available this way. In the case of the organic chemistry laboratory, only the hoods were used (the five of them!); the latter were all separated from each other with a "24-inch by 7-feet" piece of Plexiglas (as shown in Figure 2).

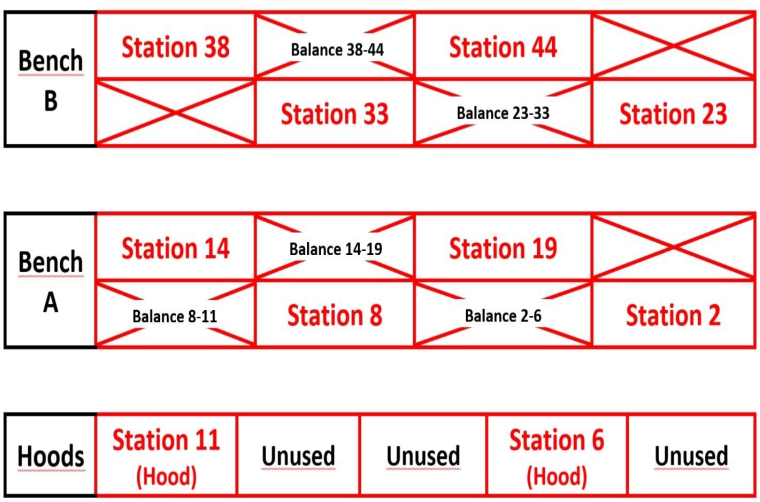

Figure 1. Workstations in the chemistry laboratory

Figure 2. Fumehoods separation with Plexiglass panels

The first-year lab room was supervised by a teaching assistant and me; students had to raise their hand to ask for any kind of help. Only my assistant and I were moving around in the lab. Relevant chemicals and pieces of equipment were placed in advance at each workstation for each experiment (at USB, professors are fully in charge of lab preparation by themselves). Laboratory drawers were not used as they would normally be shared between teams of students and would all require complete disinfection between each lab session. Figure 1 also illustrates how balances were located in the lab in order to allow sharing between two students only. Immediately before and after use, a procedure was followed by each student to disinfect their balance with the kit shown in Figure 3 (70% ethanol solution and paper towel).

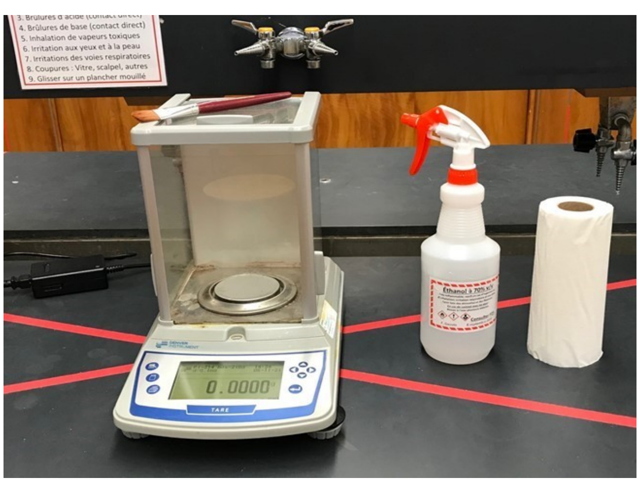

Figure 3: Balance disinfection kit

During an experiment, students took note of their measurements and observations in their lab book (Spiral bound, duplicate notebook HM SB50). Their lab preparation also required that they design (in

THE USB FIRST-YEAR "LABORATORY" EXPERIENCE - continued

advance) an experimental flow chart into their notebook. Prior to leaving (once the experiment was finished), students had me sign their lab book, put back on their own personal mask, properly disposed of the mask provided at the beginning of the session, and left the building via the same path they went through to come to the lab.

When all students were gone, my assistant and I collected all pieces of equipment to wash and disinfect them in our lab dishwasher. While the equipment was being washed, we disinfected all the laboratory surfaces using a 2-gallon sprayer bottle (containing 70% ethanol solution) shown in Figure 4. Once the disinfection procedure was completed, we certified it by signing a sheet posted on the laboratory door. This way, the maintenance people knew they could come in to clean the lab.

A similar overall procedure as the one described above shall be applied in Fall 2021 term.

Figure 4**:** 70% Ethanol solution sprayer for surface disinfection

Theoretical Courses: An Overview (or How Rapidly Adapt to Online Teaching)

Managing a relatively small group of 60 students online was not too bad. Lectures were synchronously provided via the Zoom® system, following a normal class schedule. As was the case at other institutions, we had to cut out some themes or topics from our program. For this reason, among other topics, I did not cover much nomenclature in 2020-2021. That was too bad since I often take this opportunity to reinforce students' knowledge and understanding of acid-base and redox concepts.

I gave my lectures using PowerPoint presentations converted into PDF files, which I was accessing with a program called DrawBoard®. This application allowed me to use a tablet/stylus combination tool (Bamboo Fun®, Wacom model No. CTH 661) to draw structures and give examples by hand-written notes and in real time to students. This procedure worked very well.

Regarding my quiz, tests and final exams, each of these assessments was performed in two parts via our LMS; both parts being made available at specific days/times. Part A was a downloadable questionnaire in PDF format containing relevant problems students had to solve in writing. After a specific time, students had to scan their pages (using a proper application) and submit them to me in PDF format via our LMS. Part B consisted of multiple-choice or short-answer problems programmed for a limited time on the LMS. Students' answers of Part A were marked by me (using the DrawBoard® application) and Part B questions were automatically marked by LMS.

Conclusion

Teaching theoretical courses and labs during a pandemic certainly represented a challenge for students and teachers. Everybody was doing his/her best. Overall, it has been a good experience as it forced us to prioritize laboratory knowledge and skills we wanted our students to learn, as well as major theoretical concepts they should know for their program and future courses. I must admit, though, that performing all this work was sometimes quite exhausting, but I thank our administrators (Dean of Science, Vice-President Academic-Research, Building and Grounds Director, etc.) for providing suitable support and understanding to us during this time.

ANALYTICAL SCIENCES DIGITAL LIBRARY AND OTHER DIGITAL LIBRARIES FOR TEACHING CHEMISTRY

Charles A. Lucy (charles.lucy@ualberta.ca) University of Alberta, Edmonton, AB

The Analytical Sciences Digital Library (asdl.org) is a collection of curated web pages, active-learning materials, and simulations/remote labs for the teaching of analytical chemistry. Both as an instructor and a textbook author, ASDL has been my go-to site. Each web page cited within the ASDL collection (https://collection.asdlib.org/) has been reviewed and selected by experts in the field and is presented with a detailed annotation of the site and its usefulness.

Active learning materials (https://community.asdlib.org/activelearningmaterials/) include:

- in-class activities (*e.g.*, exploring HPLC behavior with a simulator by C. Lucy),
- laboratory activities (*e.g.*, quality control for a local brewery),
- shorter activities (*e.g.*, choosing the right graph, and analyzing literature articles), and
- case studies (*e.g.*, investigating cause of deaths of large numbers of flamingos in Lake Nakuru).

In response to the COVID crisis, a collection of Remote Labs and Simulations (https://remotelabs.asdlib.org/) was established in the summer of 2020. This collection includes:

- at home hands-on experiments (https://remotelabs.asdlib.org/category/at-home-hands-on-experiment/) include exploring household chemicals using a universal indicator, print and build a home LED photometer, and Beers law with a smartphone.
- skills-building exercises (https://remotelabs.asdlib.org/category/skill-building-exercizes/) in the collection include graphing with Excel and a Wikipedia project where students create a biographical Wikipedia page for a scientist.
- Virtual experiments and simulations including free simulators for UV-visible and fluorescence spectrophotometers, gas chromatography, a variety of HPLC simulators (1, 2, and 3 which I used for my in-class activities), capillary electrophoresis, and Fourier transform for NMR. Exercises and experiments using a cyclic voltammetry (J. H. Brown, *J. Chem. Educ*. **2015**, *92*, 1490) and ion chromatography using Thermo Fisher's free *Virtual Column Online* will be added this summer.

Other Useful Collections

Other collections that I am aware of by have not used as extensively are:
ChemEdX (https://www.chemedx.org/) focuses on precollege and two-year college chemistry education. Its Xplore collection includes:

- activities such as paper tool for teaching organic nomenclature, colourful sugar density column demo and virtual lab activity on stoichiometry
- articles and videos such as highlights from each issue of *Journal of Chemical Education*, learning games for high school and college students, and standards-based grading
- and monthly newsletters.

ChemCollective (http://chemcollective.org/) whose objective is "*to support a community of instructors interested in improving chemistry education through interactive and engaging online activities*". Resources are sorted by topic (stoichiometry, thermochemistry, kinetics, equilibrium, acid-base chemistry, solubility, electrochemistry, analytical/lab techniques, physical chemistry, and solutions) and by type (virtual labs, autograded problems, tutorials, scenario-based activities, molecular visualizations, simulations, and concept tests).

Virtual Inorganic Pedagogical Electronic Resource (**VIPEr**, https://www.ionicviper.org/) is a repository of inorganic chemistry materials, and a platform for virtual collaboration and inorganic community building. Teaching resources can be searched by *learning objective type* (*e.g.*, in-class activity, problem set, lab experiment, *etc*.), *subdiscipline* (*e.g.*, bioinorganic, f-block, nano, spectroscopy and structural methods, *etc*.), and *topics* (*e.g.*, bonding models, communications skills, diffraction, kinetics, *etc*.). Community has forums on opportunities, research, and teaching.

ANALYTICAL SCIENCES DIGITAL LIBRARY - continued

CIC Chemistry Education Division (http://chemedcanada.com/) and the **ACS Students & Educators** (https://www.acs.org/content/acs/en/education.html) and **Royal Society of Chemistry Education** (https://edu.rsc.org/) each have a wide variety of resources.

Lab safety videos is a collection of videos curated by Jyllian Kemsley of *C&E News*. https://docs.google.com/spreadsheets/d/16CXF7AAsyd8VN7Na0dkQ1p2cB3nwrQxVZXWRWg52TDQ/edit#gid=0

Chemistry in Pictures (https://cen.chempics.org/tagged/cenchempics) is a *C&E News* collection of spectacular photos and images related to chemistry.

CHEMIX: FOR THOSE OF US WHO CAN'T DRAW

Carl Doige (cdoige@okanagan.bc.ca) Okanagan College, Vernon, BC.

In the spring of 2020, when I learned that we would be preparing resources for online labs, I scoured the internet for tools that would support us in our efforts. I wanted to make a series of cartoons to show the layout for the experimental steps. My hope was that this would provide context for the students as they watched our homemade lab videos. I knew that many of the draw software (ChemDraw®, ChemSketch®) came with lab equipment templates, but I didn't find these particularly easy or versatile to use. Fortunately, I stumbled onto to the Chemix® platform (https://chemix.org/). While there is a free version, I upgraded to the "Boost" version ($40 CAN/year) which provided more types of apparatus, better quality images, better text features, permission for commercial use, and significantly more cloud storage). Initially the platform was designed for chemistry lab set-ups but now it has expanded to biology and physics.

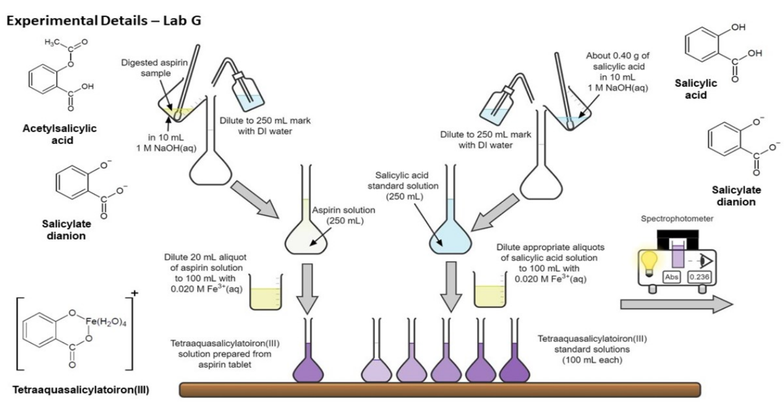

Figure 1. Drawing made from Chemix®, ChemSketch®, and PowerPoint.

I am impressed with the quality of the vector graphics and that there is a considerable versatility built into the drawing features. One can specify volumes (and colour) of liquid in glassware. If the glassware is tilted, the liquid adjusts accordingly. Figure 1 was designed mainly in Chemix®, but then imported into Powerpoint so that I could add chemical structures that were made in ChemSketch®. About 50 such diagrams were made for the various first year labs.

I am also impressed that platform is constantly being updated with new features. Some of these changes were the result of me reaching out to the designers through the platform's "chat box" and requesting for certain features to be added.

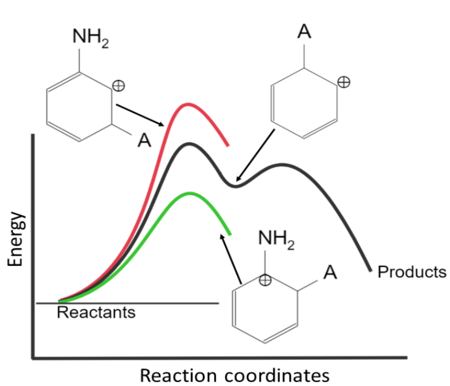

Figure 2. Drawing with smooth curved lines

While I have used Chemix® mainly for lab drawings, I was excited to discover a very versatile curved line drawing feature. I am now equipped to better draw the "Energy versus Reaction Coordinates" type graph shown in Figure 2, which was always pathetic looking in my pre-Chemix® attempts.

Given my unbridled enthusiasm for this platform, the reader may wonder if I have been given some kind commission or other remuneration. The simple fact is that while the 2020/2021 teaching year challenged us in so many ways, it also brought many new opportunities and resources. Here is one resource that "saved" me during the pandemic, but will also prove to be part of my toolbox of COVID Chemistry education worth Continuing.

THE PRESIDENT'S MESSAGE

Let me start off saying I'm not much of a writer. By that I mean give me a procedure or technical document and I can fill the page quicky but an article for the newsletter is a whole other thing. I feel that this is also how I see teaching online.

When I have someone in front of me I can talk, teach, engage and feel some confidence that I am delivering the material in a way that the students can understand. I can see when they need more information by that look in their eyes. I can hear the chatter and scratching of writing that tells me they are present. Some even laugh at my usually ill-timed and very lame chemistry jokes. I can add more information or examples or activities to ensure that I am engaging them in learning. In short, I can communicate efficiently and effectively.

Teaching on-line is that whole other thing I mentioned. The audience is deafeningly quiet leaning on absent. I am talking to myself. Is anyone even there? Maybe there is one student per class identified as the sacrificial lamb to take notes. I record my lectures so it is possible there is no-one out there other than they have turned on the lecture and subsequently went back to bed. I have requested students ask questions and answer my questions. Sometimes I get no response (insert cricket chirp here.) I am very hesitant to ask them to turn on their cameras so I can see them.

So what is a chem instructor to do? Well, I attended the 47th annual C3 conference held virtually – that's what I did. I will be going into next semesters online classes with an arsenal of tools, tips and tricks graciously provided by our C3 members. Virtual lab experiments, apps for assessment and practice and methods of student engagement. Although I am not privy to the contents of the newsletter, I hope the articles held within contain many of the things I learned during the conference. If not, attendees will have access to recorded session for any that they missed.

In closing, I must say I was in awe of the organizing committee who put together a two day conference in about a month. Not only did they put it together, but they executed it seamlessly. A huge shout out to Carl Doige – who put those videos together to have available after the conference, created and managed a survey and then put together this newsletter. To all of the organizing committee – Yann Brouillette, Kathy Darvesh, Carl Doige, Francois Gauvin, Jimmy Lowe and Charles Lucy – THANK YOU!

I hope everyone has a fantastic summer.

Paula

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