

“In a little you can see a lot”: Variety and impact of practical microscale chemistry

Robert Worley FRSC, MSc, BSc

Chemistry Adviser (semi-retired) to CLEAPSS in the United Kingdom

Practical microscale chemistry made little impact on teachers in the United Kingdom who have, for over a hundred years, supervised and carried “normal scale” practical experiments safely, due to the expertise in teachers trained in traditional chemistry techniques and trained technicians. These trained personnel are sadly declining in numbers and there has been a reduction of practical work as teachers are “teaching to the test.” This has changed recently and there is more variety in students now do. To add more variety, microscale methods have gained in popularity.

However, factors such as expense of chemicals and equipment, safety and environmental reasons are also becoming more important. CLEAPSS introduced microscale techniques initially for safety reasons but now we are seeing added benefits such as improved classroom management, reducing cognitive load on the short term-working memory, challenging long-held misconceptions with regard to chemistry at the molecular/ionic level and even developing completely new experiments for students and demonstrations for teachers.

The Examination Boards in the UK are taking these techniques on board which adds extra gravitas to their bank of exemplar experiments. The talk with demonstrations and videos will summarize this “added value” with live demonstrations such as catalytic cracking and the microscale Hofmann voltameter. There will also be two round robin workshops for teachers to try using conductivity indicators, puddle chemistry and diffusing gases. The procedures have been collected and adapted from the support and work of various enthusiasts of micro and small scale chemistry around the world such as Bruce Mattsonⁱ David Katzⁱⁱ (US) Jorge Ibanez (Mexico), John Bradley (South Africa) and many others.

With modern, yet inexpensive, IT facilities there are still plenty of wonderful imagesⁱⁱⁱ to inspire students and present images that require subtle, yet important, interpretation.

CLEAPSS^{iv} consists of a small group experienced science teachers, financed by subscription of employers and independent schools that works closely with the Department for Education and the UK Health & Safety Executive, to ensure that teachers, school technicians and students work safely during science practical lessons. In order to minimize risk and reduce costs both in monetary and environmental terms, and in compliance to EU and UK safety law, CLEAPSS has pioneered new and novel procedures in all sciences. Many Norwegian teachers visit CLEAPSS the ASE conference every January^v.

UNESCO^{vi} promoted microscale techniques from John Bradley in over 70 countries, to involve children in practical work where there are few laboratory facilities. Now we can see that these techniques have much to offer too all teachers of chemistry.

ⁱ http://mattson.creighton.edu/Microscale_Gas_Chemistry.html

ⁱⁱ <http://www.chymist.com/>

ⁱⁱⁱ www.microchemuk.weebly.com

^{iv} www.cleapss.org.uk

^v <https://www.ase.org.uk/annual-conference/>

^{vi} http://portal.unesco.org/science/en/ev.php-URL_ID=6811&URL_DO=DO_TOPIC&URL_SECTION=201.html