

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

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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 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, while conducting laboratory classes was of a huge challenge for chemistry educators. 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 the 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 be continued 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

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content information is done through the LMS and the practice part is done in the face-to-face setting which is highly 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.