

POINT OF VIEW

How has the pandemic accelerated the transformation of Analytical Chemistry education from Generation Z to Alpha?

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Teaching Generation Z (Zs or Centennials) has become a great challenge since students arrived at the university classrooms meeting professors of different generations, from Baby Boomers, through Generations X and Y (Millennials) and even young assistants of the same generation. This became an interesting challenge to tackle, and we thought this transition was going to take a while. But suddenly, in the year 2020, a pandemic began, something totally unexpected that left us in shock, and without a reaction time for transitions, those of us who teach experimental sciences in universities were forced overnight by the most incredible challenges to improve our creativity to maintain the quality of teaching of Analytical Chemistry. There was no time to identify with any generation... suddenly we were all Zs (the digital generation) and additionally began to know about Generation Alpha.

From my point of view, as a woman of Generation X (mavericks seeking success), and as a Professor of Analytical Chemistry, having started as an assistant in classes of this discipline in 1996, I would like to share my experience on how the pandemic irreversibly accelerated the use of digital tools, not to get closer to Generation Z, but without realizing it, reaching a transition to Generation Alpha (those born in the 2010s), despite the fact that they have not yet arrived at university.

Generation X and earlier were used to face-to-face classes, to the university coexistence of many hours in the classrooms and in the libraries. Then we began to think about virtual classes, digital platforms, enabling work to be done with the help of internet resources, but suddenly... chaos! In 2020, there were worldwide restrictions on face-to-face access to university classrooms, and now what do we do? Thinking about Analytical Chemistry, we could teach the theoretical content online, but what about the experiments in the laboratory? The use of instruments? Exams and evaluations? It was real chaos; teachers experienced anxiety and higher levels of burnout. Communications via cell phones and messages became the form of contact and the number of e-mails skyrocketed. Teleworking, with the family around, work without a fixed schedule and an infringement of privacy, became the norm. Those were difficult times; those teachers closest to Generation Z adapted more quickly; for those of the Baby Boomer generation the situation accelerated their retirement processes; and for those of us from Generation X or Y... we could be considered survivors.

Once the pandemic ended, at least in our university, we waited with great enthusiasm for the return to classrooms expecting to see them full of students; however, we went through another shock: the theoretical classrooms were empty. During the pandemic, a lot of recorded material was generated through digital platforms that the students themselves later requested to the authorities to be kept online, so they stopped attending theoretical classes. Now they say, "we are the owners of our time, and we can watch the videos

at any time". The first feeling was of great frustration, but we consider that this is already irreversible, so how do we adapt to these new times of post-covid teaching?

In my opinion, the current teaching of Analytical Chemistry can be improved in several aspects. First, many programs focus on theory and memorizing concepts; this is rejected by the Z and Alpha generations who value focusing on the practical application of analytical methods. Furthermore, the teaching of Analytical Chemistry is often limited to traditional methods and does not focus enough on new technologies and trends in the discipline. This can leave students outdated and not well prepared for the professional world. These aspects are often the product of scarce economic resources that disable the access of undergraduate students to use sophisticated instruments; however, it is important to achieve such access, at least with several experiments throughout their careers.

Based on the literature, some surveys carried out with students in our faculty, and my own experience, it is time to jump directly to what Generation Alpha will demand. Use interactive and visual materials, avoid extensive texts, and use short videos, animations, and simulations instead to explain complex chemical concepts. Relate chemistry to real-life situations since they will be interested and concentrated if they can see how it applies to their daily lives. If we explain how chemical reactions affect their health, the food they eat, and the environment, with examples taken from the news, and generate social network content, we will catch their attention.

Encourage experimentation so they can learn through hands-on experiences. Incentivize them to participate in peer-to-peer learning to promote collaboration. Another novelty is to "gamify learning" since these generation are "gamers"; for example, we can use rewards, badges, and leaderboards. This experience was used in courses of Instrumental Analysis in our faculty this year and it was a very successful strategy. The students also learn how to lead and negotiate with other students, which is very valuable because in terms of communication, Generation Alpha was diagnosed to be more closed and behave more individually than Zs; besides, they are known as "tech thumbs" (an individual action). It has been reported that this could be due to the behavior of their parents, depending on which generation the parents belong to.

These are just some tips. Professors can try to make chemistry education more engaging and effective for these generations, tracking the characteristics of these generations, thus having a broad perspective to be prepared for the future.

In summary, despite having been one of the teachers who suffered burnout during the pandemic, reinforced by belonging to Generation X, this crisis left, from my point of view, great learning, and adaptability. I believe that we can continue enjoying the teaching of Analytical Chemistry by adapting to new trends and that it is important to know the characteristics of the new generations.

Finally, I leave my colleagues with one final question... are you ready for the era of ChatGPT and artificial intelligence?

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