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ICT: PBL ONLINE PHARMACEUTICAL PHYSICAL CHEMISTRY UPDATE EXPERIENCES OF TEACHERS BABY BOOMERS AND MILLENNIALS

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ABSTRACT

The experiences and opinions of a group of Baby Boomers and Millennials professors are presented with the use of technologies, learning, experimental data management, communication, and empathy during an online Pharmaceutical Physical Chemistry training course.With the teaching strategy of learning based on problems, teachers coordinated by the instructor solve the problem: *What is the shelf life (expiration date) of an extemporaneous preparation of aspirin stored in refrigerationthrough PBL cycles*. With data from a virtual experiment, they solve the problem using the Excel worksheet, where they perform calculations and graphs. They then answer a Likert satisfaction survey.The results indicate that the Teachers Baby Boomers and Millennials who take online training courses observed that teachers have the tools such as computer and internet, as well as an adequate space to take the course. However, find it difficult to obtain apprenticeships, mathematical treatment of experimental data, as well as communication between their peers and with the teacher than when taking courses in person. These difficulties are greater in teachers of the Baby Boomers generation than the Millennial generation. The difficulties that teachers havewhen taking online courses will allow them to understand the problems presented to students during the online learning teaching process.Due to the emergence of delivering all online courses through the COVID-19 pandemic, there are problems and challenges for academic staff that require ever higher levels of technological competence, better communication skills and online teamwork, to obtain better learning and thus improve the online teaching and learning process.

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INTRODUCTION

The teaching learning of Pharmaceutical Physical Chemistry for the career of Pharmacy and related careers, at the Faculty of Cuautitlán Higher Studies of the National Autonomous University of Mexico UNAM, is taught in an experimental theoretical way, usually with exercises and practices. Various teaching strategies have been used to stimulate interest and promote meaningful learning in students. For the improvement of the learning teaching process, a lot of teaching strategies have been designed, including problem-based learning (PBL) (Woods, 2014). PBL is the learning that results from the entertainment process or solution of a problem (Obaya, 2018). PBL offers students an obvious answer to questions: Why do we have to learn this information? And what I do in school have something to do with the real world? (Obaya, 1995)

PBL is a teaching method that substantially increases students' motivation, since by its dynamics it makes students active subjects of the learning teaching process (Vargas Rodríguez et al, 2020). The student is also the center of this process and working with this method requires teamwork of non-individual students (Williams, 2016); (Obaya, Vargas-Rodríguez, Giammatteo, & Ruiz Solórzano, 2019). PBL consists of the approach of a problem situation; where its construction, analysis and/or solution are the central focus of experience, and where teaching is to deliberately promote the development of the process of inquiry and resolution of problems. The various modalities adopted today by the PBL are elements of the constructivist theories of learning, which highlight the need for students to research or intervene in their environment and build for themselves meaningful learnings (Obaya, Vargas, & Delgadillo, 2011). PBL is based on the principle of using problems of everyday life or professional exercise as a starting point for the acquisition and integration of new knowledge.

Generations and technology: A generation is defined as "a set of historical events and related phenomena that create a distinct generational difference (Parry, & Urwin, 2011). Every generation arises according to the date of birth, and they have a specific social behavior, such as the Baby Boomers (1945-1960), Generation X (1961-1980), Millennials (1981-1995). Several authors slightly modify these age ranges and even the name of the generations (Table 1). Baby boomers are now over 60 years old and millennial teachers are between the age of 25 and 39. La generation Baby Boomers grew up with transistor radios, mainframe computers, 33 and 45 rpm records, and the touchtone telephone (Oblinger&Oblinger, 2005). Baby Boomers have impacted almost every aspect of society experienced rapidly expanding economic circumstances that led to a sense of financial security. A lasting optimism permeates baby Boomers, who are process-oriented, concerned about convenience and willing to borrow. They hold senior positions in all sectors and draw attention to their likely impact on the economy of nations whenthey retire (Oblinger, 2003). Millennials grew up in an electronic era, navigating their lives in an online environment with the back of social media sophistication. This group of people generally adapts easily to change, learns new operating systems, and performs computer-based work more competently and quickly than generations X and Boomer (Kushniryk & Levine, 2013).

Table 1. Names of generations according to different authors

Generation,						Reference
Silent Generation	Baby Boomers	Generation X	Millennial Generation	Generation Z	Gen alpha	
(1925-1945)	(1943-1960)	(1961-1981)	(1982-2000)			Howe & Strauss, 1991
	1946-1964	1965-1975	1976-2000 Digital Generation			Tapscott, 1998
1922-1943 Veterans	1943-1960	1960-1980 Gen Xerr	1980-1999 Nexters			Zemke, Raines &Filipczak, 2000
(1900-1945) Traditionalist	(1946-1964)	(1965-1980) Generation Xers	(1981-2000) Echo Boomer Generation Y Baby Busters Generation Next			Lancaster & Stillman, 2002
(1925-1942)	1946-1960	1965-1977	1978-2000			Martín &Tulgan, 2001
<1946 Matures	1947-1964	1965-1975 Generation Xers	1981-1995 Gen-Y NetGen	1996-2007		Oblinger, 2003
					2010-2024	McCrindle & Wolfinger, 2009

Generations and online learnings: In one study (Oblinger & Oblinger, 2005), Baby Boomer students were found to have a more positive learning commitment. However, the Baby Boomers lamented the lack of face-to-face interaction in the online environment, a comment consistent with this generation's tendency to discuss and tell stories.With the current use of tablets and personal computers pharmacy students from some universities prefer a combination of classroom teaching and online learning. According to Howe and Strauss (2000), three attributes that more clearly identify the nature of a generation than years of birth are:

- Perceived membership: The self-perception of membership within a generation that begins during adolescence and coalesces during young adulthood.
- Common beliefs and behaviors: The attitudes (toward family, career, personal life, politics, religion, etc.) and behaviors (choices made regarding jobs, marriage, children, health, crime, sex, drugs, etc.) that characterize a generation.
- Common location in history: The turning points in historical trends (e.g., from liberal to conservative politics) and significant events that occur during a generation's formative years (adolescence and young adulthood).

Due to the COVID-19 pandemic, in 2020, The National Autonomous University of Mexico (UNAM) offers continuous training to its teachers, but, in the first call of 2020 (courses in June-July), all their online courses were offered for the first time. UNAM recently published the results of the follow-up questionnaire that was applied to teachers in the last two weeks of June 2020 once teachers were concluding the semester, which was suddenly impacted by Covid-19 global disease (UNAM, 2020). This paper analyzes teachers' point of view through an online Likert satisfaction survey to assess the difficulties teachers present based on their generation, who take an online training course based on a PBL online teaching sequence was originally designed for calculating the shelf life (expiration date) of an on-site solution of refrigerated drug date) of an onsite solution of refrigerated drug.

METHODOLOGY

An online Pharmaceutical Physical Chemistry course was taught, in a total of 42 hours, during the months of June and July 2020. The course was held in 12 sessions of 3 hours each, through video platform and audio online conference Zoom, at a schedule of 5:00-8:00 pm. The tools used were PowerPoint presentations, the Excel spreadsheet, and a Wacom tablet. The population was 10 professors of Physical Chemistry of the Faculty of Higher Studies Cuautitlán (FESC) of UNAM. Teacher ages ranged from 25 to 65 years (5 women and 5 men). They were ranked based on their age in Baby Boomers and Millennials generation the online course was developed interactively, as it was developed under Problem-Based Learning (PBL), so the course teacher directing the after finishing the course, the teachers answered evaluation information, which was uploaded to the Google forms platform. The items were divided into five sections, which are described below, and the items are presented in the Table I.

General data,

- Technological problems,
- Trainer and teacher-teacher interactions,
- Learning,
- Usefulness of apprenticeships, and
- Empathy.

PBL Online Development Steps

I. Teachers who took the course were presented with the example problem: *Calculating the shelf life (expiration date) of an on-site solution of refrigerated drug.*
II. Teachers were then instructed to carry out collaborative activities for the search for information, with the aim of resolving the problem raised.
III. Through a video the teachers performed the "experimental collaborative activities online" for data collection, where they observe the laboratory work in a different way than the "traditional recipe" because it is a contextualized experimentation.In Figure 1, experimental development is outlined
IV. Teachers collected experimental results, as well as observations, photographs, and videos (depending on the problem being worked on).

V. Teachers assessed the impact and environmental impact of experimental collaborative activity and made proposals for the treatment and disposal of waste.
VI. Subsequently, the teachers realized procedural collaborative activities, through the Excel spreadsheet, with the aim of solving the problem raised, and that each teacher discussed the resolution of the PBL cycles that arose. The facilitator guided teachers in the processing of experimental data, when necessary.
VII. Finally, teachers delivered a written report and an oral seminar with visual support of PowerPoint-type parcels in which they presented: the problem, objectives, hypotheses, description, and argumentation of the procedures used for the determination and obtaining of the required physicochemical parameters, as well as the solution of the problem, generated their own conclusions and appended the bibliography used.

The sessions were developed based on a problem situation, teachers involved and intervened in their academic environment to build meaningful learning on their own when solving the problem. In this regard, Table 2 presents the titles of the problems that were worked on during the workshop and the significant learnings to be achieved.

FINDINGS AND DISCUSSIONS

Once the example problem has been presented *What is the shelf life (expiration date) of an extemporaneous preparation of aspirin stored in refrigeration* (Vargas Rodriguez et al, 2020*)*, some questions arose that teachers solved in PBL cycles. Some of these questions are presented below:

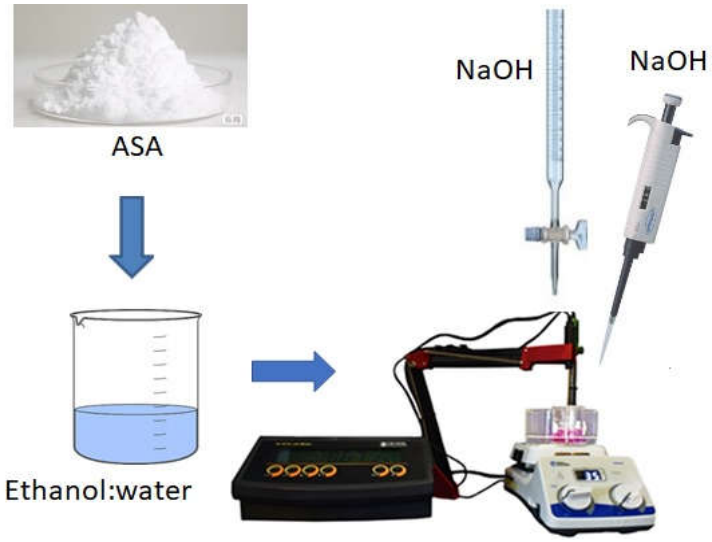


Figure 1. Experimental development of AAS degradation

Table 2. Significant problems and learnings to achieve

1	What is the content of a metformin hydrochloride tablet?	Basics of conductimetry. Conductance of the ions. Conductimetric titration.
2	What is the half-life of an extemporaneous preparation of acetylsalicylic acid?	Extemporaneous preparations, Drug degradation, Chemical kinetics, Reaction Order, Comprehensive Graphical Method, Half-Life Time Method and Constant Determination Method
3	What is the shelf life (expiration date) of an extemporaneous preparation of aspirin stored in refrigeration?	Temperature effect on rapid reactions, Arrhenius Equation: Collision Theory, Eyring Equation: State of transition theory. Accelerated stability studies. Expiration date,
4	Is there bioequivalence between GI and patent ranitidine hydrochloride tablets, available on the market?	Dissolution of solid active ingredients. Dissolution theories. Importance Particle size pharmaceutical. Bioequivalence: dissolution models (zero order, first order, square root, cubic root). Glass, polymorphism, solid amorphous. Crystallization and factors that affect the shape of the crystal. Stability of polymorphism and its bioavailability.
5	What are the pharmacokinetic parameters of ADME and the metabolism of a drug?	Pharmacokinetics (LADME). Enzymatic kinetics, Michaelis-Menten Equation, Nonlinear kinetics, Lineweaver-Burk equation, Reaction order: differential methods.
6	What angle of contact do pure compounds have on hydrophilic and hydrophobic surfaces?	Wet, Contact Angle, Surface Voltage, Surface Energy, Cohesion, Adhesion, Capillary, capillary elevation.
7	How to increase the solubility of a surface?	Surfactants, Excess Surface Solute. Surface pressure. Monolayers. Micelles. Critical micellar concentration. Humectability of hydrophobic drugs. Dry eye moisturization.
8	What is the maximum amount of drug that can adsorber one gram of adsorbent?	Adsorption of soluble drugs on surfaces, adsorption isotherms (Henry, Freundlich, and Langmuir). Micromeritics: Textural properties of powder systems (pore size, specific surface area) BET and BJH
9	How to separate the colloidal particles of kaolin (dispersed phase) from their dispersing phase?	Colloidal systems: lyophilic and lyophobic. Preparation methods: condensation and Colloid properties (Tyndall effect), particle size
10	What are the values of intrinsic viscosity, hydration volume and hydrodynamic radius of PVP colloid?	Viscosity, flow types and fluids (Newtonian and non-Newtonian systems). Thixotropy and viscoelasticity. Water soluble and insoluble polymers used in Pharmacy: carbomer, derivatives of cellulose, natural gums, and mucilage, PVP, silicones, ion exchange resins, aluminosilicates, etc.,
11	How to keep hydrophobic colloidal particles suspended at an aqueous continuous phase?	Zeta Potential or Electrokinetic Potential. Shulze-Hardy rules and their relationship to the stability of Colloidal Systems. Protective colloid
12	How to formulate and prepare a physically stable pharmaceutical suspension?	Suspensions. Preparation. Features and properties. Factors that influence stability. LDVO theory

- ¿Why do you need to prepare out-of-time solutions?
- What is the expiration date?
- How is the expiration date determined?
- ¿What is an Accelerated Stability Study?
- ¿How are constants determined quickly?
- ¿What is a kinetic study?
- ¿What degradation reaction does the AAS molecule have? (Fig. 2)
- What reaction kinetics does AAS hydrolysis have?
- ¿What is the cooling temperature?

With sufficient research to solve the problem, physical chemistry teachers retrieved the experimental data, which is the pH values based on the time of the reaction at three temperatures: 313.15, 323.15 and 323.15 K respectively and placed them on an Excel sheet (Figure 3a). Teachers then charted in Excel pH vs temperature (Figure 4a) where they analyzed and concluded that the fastest reaction is carried at higher temperature, due to the increased decrease in pH.

Subsequently, teachers analyzed the *pH change,* concluding that it is due to the Hydrolysis reaction of NaOH with the AAS ester. Then, to follow the rapid reactionquantified the remaining concentration of the NaOH, therefore, they converted *the pH values* to *pOH* from the equation *pKw s pH + pOH,* using the Excel tools, as seen in Figure 2b, where the teachers used the formula *.14 - pH*. Then, from the *pOH values,* the teachers determined, the concentration of [$^-$OH] in mol L^{-1}, and from this theinverse concentration of $[^-OH]^{-1}$ in mol^{-1} L. This activity was performed again in the Excel worksheet (Figure 3b). In addition, teachers adjusted the concentration results to the second-order model, plotting the OH concentration inverse data based on time to linear regression (Figure 4b). Using the equation of Arrhenius in its linear form $ln\ k = ln\ A - E_a/RT$, where k is the constant of speed in $M^{-1}s^{-1}$, A is the frequency factor in $M^{-1}\ s^{-1}$, Eais the activation energy, R is the universal gas constant in J mol^{-1} K^{-1} and T the temperature in K, teachers calculated in Excel the inverse temperature (T), as well as the natural logarithm of the rapidity constant (k) at each working temperature. It is important to mention that the teachers agreed that the cooling temperature to consider is

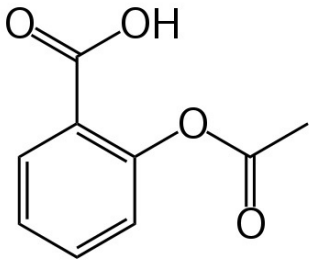
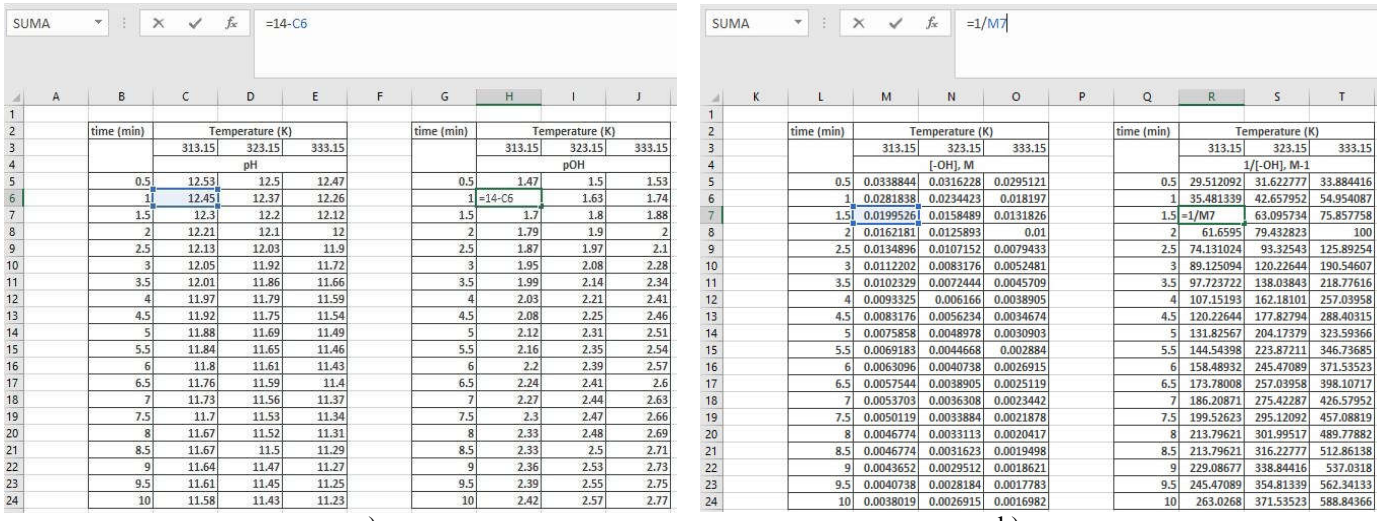


Fig. 2. Acetilsalicilic acid



time (min)	Temperature (K)			time (min)	Temperature (K)		
	313.15	323.15	333.15		313.15	323.15	333.15
	pH				pOH		
0.5	12.53	12.5	12.47	0.5	1.47	1.5	1.53
1	12.45	12.37	12.26	1	=14-C6	1.63	1.74
1.5	12.3	12.2	12.12	1.5	1.7	1.8	1.88
2	12.21	12.1	12	2	1.79	1.9	2
2.5	12.13	12.03	11.9	2.5	1.87	1.97	2.1
3	12.05	11.92	11.72	3	1.95	2.08	2.28
3.5	12.01	11.86	11.66	3.5	1.99	2.14	2.34
4	11.97	11.79	11.59	4	2.03	2.21	2.41
4.5	11.92	11.75	11.54	4.5	2.08	2.25	2.46
5	11.88	11.69	11.49	5	2.12	2.31	2.51
5.5	11.84	11.65	11.46	5.5	2.16	2.35	2.54
6	11.8	11.61	11.43	6	2.2	2.39	2.57
6.5	11.76	11.59	11.4	6.5	2.24	2.41	2.6
7	11.73	11.56	11.37	7	2.27	2.44	2.63
7.5	11.7	11.53	11.34	7.5	2.3	2.47	2.66
8	11.67	11.52	11.31	8	2.33	2.48	2.69
8.5	11.67	11.5	11.29	8.5	2.33	2.5	2.71
9	11.64	11.47	11.27	9	2.36	2.53	2.73
9.5	11.61	11.45	11.25	9.5	2.39	2.55	2.75
10	11.58	11.43	11.23	10	2.42	2.57	2.77

a)

time (min)	Temperature (K)			time (min)	Temperature (K)		
	313.15	323.15	333.15		313.15	323.15	333.15
	[-OH], M				1/[-OH], M-1		
0.5	0.0338844	0.0316228	0.0295121	0.5	29.512092	31.622777	33.884416
1	0.0281838	0.0234423	0.018197	1	35.481339	42.657952	54.954087
1.5	0.0199526	0.0158489	0.0131826	1.5	=1/M7	63.095734	75.857758
2	0.0162181	0.0125893	0.01	2	61.6595	79.432823	100
2.5	0.0134896	0.0107152	0.0079433	2.5	74.131024	93.32543	125.89254
3	0.0112202	0.0083176	0.0052481	3	89.125094	120.22644	190.54607
3.5	0.0102329	0.0072444	0.0045709	3.5	97.723722	138.03843	218.77616
4	0.0093325	0.006166	0.0038905	4	107.15193	162.18101	257.03958
4.5	0.0083176	0.0056234	0.0034674	4.5	120.22644	177.82794	288.40315
5	0.0075858	0.0048978	0.0030903	5	131.82567	204.17379	323.59366
5.5	0.0069183	0.0044668	0.002884	5.5	144.54398	223.87211	346.73685
6	0.0063096	0.0040738	0.0026915	6	158.48932	245.47089	371.53523
6.5	0.0057544	0.0038905	0.0025119	6.5	173.78008	257.03958	398.10717
7	0.0053703	0.0036308	0.0023442	7	186.20871	275.42287	426.57952
7.5	0.0050119	0.0033884	0.0021878	7.5	199.52623	295.12092	457.08819
8	0.0046774	0.0033113	0.0020417	8	213.79621	301.99517	489.77882
8.5	0.0046774	0.0031623	0.0019498	8.5	213.79621	316.22777	512.86138
9	0.0043652	0.0029512	0.0018621	9	229.08677	338.84416	537.0318
9.5	0.0040738	0.0028184	0.0017783	9.5	245.47089	354.81339	562.34133
10	0.0038019	0.0026915	0.0016982	10	263.0268	371.53523	588.84366

b)

Figure 3.a) pH and pOH data, concentration of $^-$OH;b) OH concentration inverse data, at different temperatures

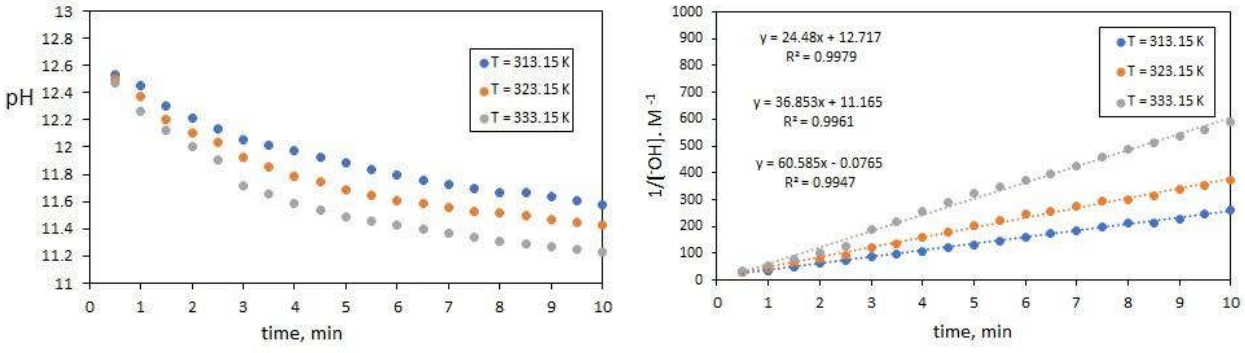


Figure 4. a) pH vs time for ASA hydrolysis and b) fit the second order kinetic model

279.15 K, so they added it to the calculations (table 3), despite not having the k data at that temperature, which allowed them to automatically plot *the graph of ln k vs 1/T* (Figure 5)and adjust to a linear regression that the adjustment line (dotted) will automatically extrapolate to the value of 0.0035823, equivalent to the inverse of the temperature of 279.15 K and subsequently, add a line to interpolate with the y-axis, to get the ln k at the temperature of 279.15 and determine the speed constant. Finally, the teachers determined the expiry date using the second-order kinetic equation$t_{1/10}$= 1/9kA_o.

Table 3. Data for the graphic of the Arrhenius equation

Temperature (K)	k, M^{-1} min^{-1}	1/T, K^{-1}	ln k
279.15		0.0035823	
313.15	24.48	0.00319336	5.74668231
323.15	36.853	0.00309454	5.77811661
333.15	60.585	0.00300165	5.80859284

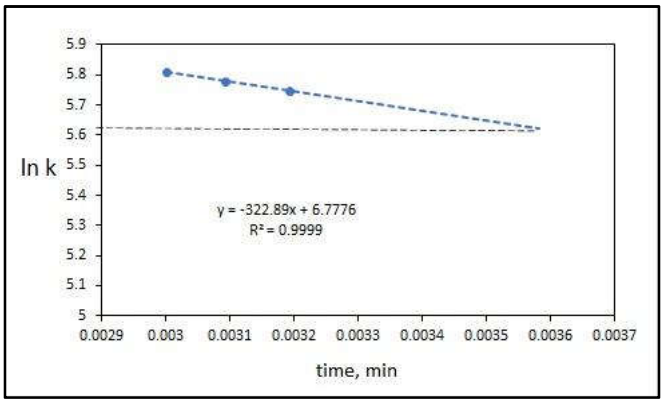


Figure 4. Extrapolation to storage temperature

From a training point of view, both Millennials and Baby Boomers had no problems using the Excel spreadsheet and performing calculations (Figure 2), making charts, and selecting and naming the data for each series in the charts (Figure 3), as well as extrapolating (Table 3) and interpolation and directly on the chart (Figure 5).After collecting the results of the form with the items, each of the answers was assigned a number, the response completely agreed a score of 4, partially according to 3 points, to neither agree nor disagree 2 points, partially disagree 1 point and zero points to completely disagree. The sum was made, and the percentage was determined, as shown in Figure 1. In addition, the answers were classified based on the generation of teachers 26 to 39 years (7 teachers) as Millennials and from 56 to 67 years as Baby Boomers (3 teachers) (Oblinger, 2003), as shown in the Table 4.

Table 4. Age and generation of participants

No.	Gender	Age in 2020	Years old	Generation
1	H	26	3	Baby Boomer
2	M	27	3	Baby Boomer
3	M	27	3	Baby Boomer
4	M	30	5	Baby Boomer
5	M	30	5	Baby Boomer
6	M	35	5	Baby Boomer
7	M	35	10	Baby Boomer
8	H	60	25	Millennial
9	H	63	35	Millennial
10	H	65	40	Millennial

As for the tools and the internet (item 1 to 4) the Baby Boomers teachers, they had a satisfaction rate of 100, 100, 92 and 100% compared to millennials of 100, 95, 83 and 100% respectively, so it is considered that both Baby Boomers and Millennial teachers had at home the right tools to take the course online. Although it is reported that the management of technological equipment such as the computer, tablets, cell phones, etc. and their use both to do tasks, and to communicate by social networks that are more used by the Millennial generation than by the Baby Boomers Generation (Oblinger&Oblinger, 2005).This is not 100% true with baby boomers university professors, due to generally to teach their courses to student of generation X, millennial generation and even to generation Z, handles technology at a level higher than the average of its generation. In the field of Communication Trainer-Teacher and Teacher-Teacher, Baby Boomers teachers had 42% satisfaction compared to 63% of Millennial teachers to item 5. Considering that you have more confidence to ask in online classes than in person? However, the answer at Item 6. Do you think it is easier to express yourself online than in person? It presented a 67 and 96% satisfaction for The Baby Boomers and Millennials teachers, respectively. This result indicates that while they are not confident enough to ask during online classes, teachers will contact their peers and trainer online, and item 7: Do you think is it easier to work as a team when working online than in person? It found only 17% satisfaction from the teachers of the Baby Boomers Generation, compared to 63%, of the millennial generation. Online teamwork is more difficult for baby boomers than on millennials. These results are consistent with the millennial generation being a group of people who generally adapt easily to change, learn new operating systems, and perform computer-based work more competently and quickly than generations X and baby boomer (Kushniryk, and Levine, 2013). We believe that as baby boomers university professors have more contact with online training courses, they improved in the communication and teamwork aspect.

Regarding learning, in item 8, the answer to the question Do you think it is easier to learn online than in person? the result was 58% satisfaction from teachers of the baby boomer generation compared to 68% of the satisfaction of teachers of the millennial generation. These results suggest that, although millennial generation is more technological than the baby boomer generation and that a didactic strategy (PBL) was used to improve learning and that millennials prefer to be taught lessons in class as close to real life as possible(Au-Yong-Oliveira, 2018) online learning for teachers of these generations is close to those obtained in face-to-face courses. Similar results have been reported in Generation X students (Vargas-Rodríguez et al 2020). with item 9. Do you consider that the trainer advances the topics appropriately in online classes? Baby Boomers reported good satisfaction of 74% and 82% respectively. In Item 10. Do you consider that the processing of experimental data is easier online than in person?In this case the results were 58% and 73% satisfaction of Baby Boomers teachers compared to Millennials. As can be seen in the mathematical treatment of results, described at the beginning of this section, teachers performed and showed the trainer the processing of data in Excel both individually and as a team, however, Baby Boomers teachers even though they have more teaching experience (Table 4) indicate that they present, greater difficulty in performing data processing online than in person. The results present challenges for many academic staff members who increasingly require higher levels of technological competence (Gillett-Swan, 2017). In addition to better communication skills and online teamwork, for better learning.

As for the Applying apprenticeships, Item 11. ¿Will course-related materials and topics work for your online or face-to-face courses? Millennialteacherswere 96% satisfied, comparedtothe 67% the Baby Boomersteachers, the difference in results is attributed to the more experiences and knowledge of the topics addressed by Baby Boomerss, and theItem 12. Will the course allow you to understand the problems of your students when teaching online?

Will the course allow you to understand your students' learning disabilities when teaching online? The responses of the Baby Boomers and Millennials teachers were 82 and 98% respectively, indicating that teachers regardless of generation had online learning problems and that they probably had not noticed that their students had the same problems. Among the main problems in online courses is the difficulty of communication teachers have with the facilitator,

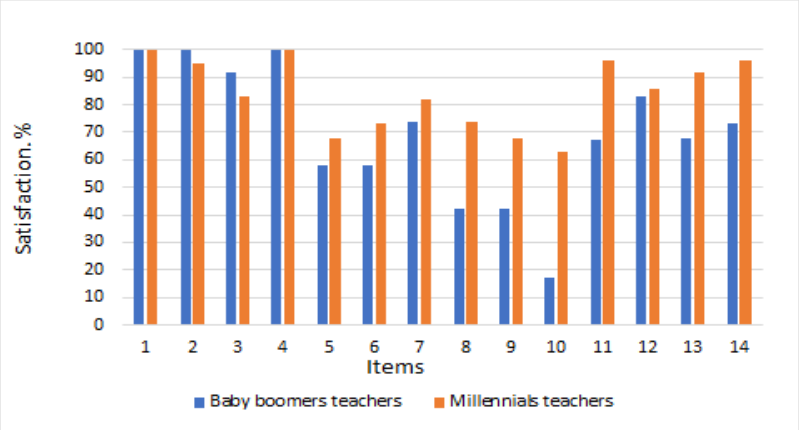


Figure 6. Likert-type survey for teachers in online training courses

Table 5. Assessment instrument

General data: Name (optional): Age: Academic antiquity	
Tools	Item 1. You had at your disposal a computer suitable for the online workshop. Item 2. You had at your disposal the internet in a suitable way for the online workshop. Item 3. Your space to take the workshop online was adequate. Item 4. Teachers had at their disposal adequate computer and internet
Communication Trainer-teacher and teacher-teacher	Item 5: Consider that you have more confidence to ask in online classes than in person? Item 6. Do you think it is easier to express yourself online than in person? Item 7: Do you think it is easier to work as a team when working online than in person?
Learning and mathematical treatment of data.	Item 8. Do you think it is easier to learn online than in person? Item 9. Do you consider that the processing of experimental data is easier online than in person? Item 10. ¿Do you consider that the teacher advances the topics appropriately in online classes?
Applying apprenticeships	Item 10. ¿Will course-related materials and topics work for your online or face-to-face courses? Item 11. Will the course allow you to understand your students' learning disabilities when teaching online?
Professor's empathy	Item 13. When teachers in your course promise to do something, they fulfill it in a timely way. Item 14. When a teacher taking a course has a problem, the course teacher shows a sincere interest in solving it.

communication between teachers and teamwork, which are triggers for social learning (Baquero, 1997) and active learning (Huffaker. and Calvert 2003). Finally, the question about empathy, Item 13.When teachers in your course promise to do something, they fulfill it in a timely way 68 and 92 and Item 14. When a teacher taking a course has a problem, the course teacher shows a sincere interest in solving it. 73 and 96. In both the satisfaction results were high for millennial teachers with 92 and 96% respectively compared to the satisfaction of the Baby Boomers teachers with 62 and 73% respectively.The difference in results between the teachers of the Millennial generation and the Baby Boomer is attributed to the communication problems that Baby Boomers teachers have.Finally, we believe that the course that integrated the experience of boomer teachers and the innovation of Millennial enthusiasts generated more successful results for all (Kosterlitz, & Lewis 2017).

Conclusions

Due to the emergence of delivering all online courses through the COVID-19 pandemic there are challenges for many academic staff members who increasingly require higher levels of technological competence, better communication skills and online teamwork, to obtain better learning and thus improve the teaching and apprenticeship process onlineAs students of a Pharmaceutical Physical Chemistry course, it is observed that teachers have the tools such as computer and internet, as well as an adequate space to take the course. They also believe that the teacher teaches the topics at an appropriate speed in online classes to achieve learning. However, teachers find it more difficult to obtain better learnings in an online course than in person, just as mathematical treatment of results is also more difficult online than in face-to-face and teachers find it more difficult to communicate between their peers and fellow teachers in online courses than in face-to-face courses. It should be noted that these difficulties are accentuated by the age of the teachers. Probably because millennials are digital natives and are therefore used to working information and Communication Technologies. Teachers who take online training courses find it more difficult to obtain apprenticeships, mathematical treatment of experimental data, as well as communication between their peers and with the teacher than when taking courses in person. These difficulties are greater in teachers of the Baby Boomers generation than the Millennial generation. All teachers consider that the teaching material and course-related learnings will be useful forums online or face-to-face courses, as well as that the course will allow them to understand the problems of their students when teaching online. In addition, the course integrated the experience of Baby Boomers teachers and the innovation of Millennial enthusiasts that generated more successful results for all.

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