

Let's learn chemistry in an active and collaborative way

Francisco Javier Cañas Urrutia¹[0000-0001-7180-1188]

¹ Andrés Bello University, 980 Quillota Street, Viña del Mar, Chile.
francisco.canas@unab.cl

Abstract. Because of COVID-19 pandemic, on-site classes were suspended as a measure of the sanitary emergency and their change to be remotely classes. At the return of on-site classes is when we observe the negative impact in the level of learning achievement, the decrease of social interaction, motivation, and collaborative learning.

Due to the negative effects on the educational process on students generated by the pandemic, the course of basis of general and organic chemistry for the first-year students, 225 on a national level wouldn't be realized in a traditional way, because if we use the teaching-learning traditional method, the significative and sustainable learning will not be achieved.

To give a quality and deep learning, a method of active learning will be used, where the methodology, strategy, evaluation, and teamwork it's going to be considered, promoting in this way the delivery of a learning that provides a superior cognitive activity.

Keywords: learning capsules, collaborative learning, active learning, deep learning.

1 Introduction

1.1 Sample Subsection

As a consequence of the COVID-19 pandemic, classes through 2020 and 2021 were realized remotely, where we observed a negative impact on the level of learning achievements, a decrease of social interaction, motivation, and collaborative learning on first year university students. Due to this, for first year students in the basis of general and organic chemistry course it was used active methodologies, pre-class readings, reading tests using the Blackboard application among others and learning capsules, after this it was realized in classes effective feedback and workshops in teams to support the collaborative work, promoting the delivery of a superior cognitive activity, which allows first year students the development of a favourable attitude to chemistry, besides an improvement on the academic performance to get a deep learning in this course.

To accomplish the previously presented, it was implemented a methodology of active and collaborative learning and feedback to the basis of general and organic chemistry course; this methodology of teaching-learning was implemented on the six sections of the course distributed on three headquarters of the University.

For this, it was necessary the design of resources, which allows the student build their own knowledge, as of lectures; to apply this new methodology, the teacher guide the learning with questions, whom allow to generate instances where the student

could back up their answers, whether be right or wrong using the blackboard to answer them, after the use of the learning capsules, feedback was carry out to the students in the learnings achieved and not achieved, to conclude with a resolution of exercises in the collaborative workshops.

To prove if these methodologies managed to improve the learning and benefit the student's attitude to chemistry and collaborative work, it was necessary resort to instruments that allow us to pick the information, for which it was designed and applied a quiz to know if these methodologies benefit the chemistry learning.

2 Theoretical framework

As a consequence of the pandemic cause by COVID-19 through the years 2020 and 2021, on site classes were suspended as a measure of the sanitary emergency and to realize classes remotely, where it is observed a negative impact in the level of learning achievements, decrease of social interaction, motivation, and collaborative learning.

Owing to the negative effects in the educational process on students cause by the pandemic, the course of the basis of general and organic chemistry (QUI075) for first year students in a career from the health care area, would not be realize in the traditional manner, which means that the students are receptors of information, and their participation on classroom is almost non-existent, therefore, it is on the outside of the class where the student make a major cognitive activity. Using the teaching-learning methodology, the significative and sustainable learning will not be achieved.

To give a deep and quality learning in this course, it will be use the active learning methodology, where is going to be considered the teaching methodology, strategy, learning evaluation and teamwork, promoting a superior cognitive activity, according to Bloom's taxonomy.

Active learning

Instructional strategies that involve the students to do and think about what they are doing. In this case, the students realize an action beyond passively listening to a lecture; they use strategies that includes active lectures to exercises where students apply the material to real life situations or new problems.

Effective feedback

Wiggins (2012) points out that "The term feedback is often used to describe all kinds of comments made after the fact, including evaluation. But none of these are feedback, strictly speaking". Schein (2013) points out that feedback can be focus on any of these three types: positive, descriptive, and neutral and even the negative aspects can be emphasized. For Kullmer and Riveros (2011) feedback is "the engine of change to the consecution of the learning aims, a measure that allows to know in a direct way and from first source, what has been accomplished so far, which are the fundamental mistakes that are produced, and which is the distance achieved and how distant it is from what we expect". However, to Ávila (2010) feedback is "... a description of facts, perceptions and feelings, is a way to help, and be co-responsible, is a natural process that occurs in different contexts in life, is specific and concrete, is a

process of continuous dialogue that leads to behaviours that can be changed, it address to the person using his name, opportune, coherent (feel, think, say) it acts as a facilitator of the personal growth". But it is common that inside the act of teaching or educational, after each activity whether in classroom or in the lab, indicate to the students that their workshops are "okay", "wrong", "could be better", "congratulations", "nice work", etc. Are these ways of making feedback? Or are they even effective? This mean, effective feedback in the workshop on classroom? Generally, the concept of feedback has been used mainly as a "correction" of the activities realized by the students, indicating the way that they had been developed, which doesn't mean that the feedback itself exist, (Amaranti, 2010). Teachers in classroom don't usually use the instance of dialogue about the analysis of results in evaluations, because the feedback is understood as a simple correction of the instrument of the evaluation, where the student check the correct and incorrect answers focus his attention on the mistakes, to certified his learning, so that, the feedback is used as an instrument to measure or to make know achievements and failures.

It is for the above mentioned, that most of the students, either elementary, middle, or higher education (university students, technical students, etc), understand the evaluation just as a qualification, worrying about why "this qualification" is inside the good or bad ranking, and not worrying about the actual meaning of it, and if we observed the teachers, they also have the same pre-disposition to the evaluation. According to Amaranti (2010): these educational practices "encourage an individualisation in the process of evaluation, in which the students get more worried about getting a good qualification than observed, know, and reflex themselves on their learning".

To promote the chemistry learning, apply feedback is an excellent strategy both from teaching to learning, but at the same time is a complex process, since it involves students and teachers, in which it must be establish a dialogue and analysis of learning, to determinate the aims that must be reach, considered that these involves the students and teachers, which means that is a collaborative process, Cordoba (2006).

Learning capsules

Learning capsules, is an educational innovation that integrates the use of information and communication technologies (ICT) in the generation of digital educational resources and contents, with the purpose of spread short thematic contents, which make easier the teaching-learning process (Gonzales Hermosilla, 2018).

The educational capsules can be defined in a general way as "short contents in which is explained in a descriptive way a key concept on education" (Palabra Maestra. Educational capsules, 2019).

3 Method

Activities of the teacher previously to the class.

It was uploaded to the "virtual classroom" the readings of all the topics on the course, subsequently, it was built a table of specifications to the reading quizzes according to the topics of the course; then it was confectioned the reading quizzes, workshops, and learning capsules.

Activities of the teacher in classroom.

Making the reading quizzes to the work teams, using as a support tool the blackboard, give feedback on the contents not acquired and monitoring the work on the workshops.

Activities of the students previously to the class.

Study the readings pre-classes and the learning capsules.

Activities of the students in the classroom.

Perform the reading quiz with the work team, attend to the feedback, work in the workshop and finally one team member presents the resolution of the workshop to the class.

4 Results

The general aim of this project was to implement the active and collaborative learning methodology, also effective feedback in the basis of general and organic chemistry course in a career of the health care area, which lead to an increase in the teaching-learning process and get a better percentage of approval on this course.

The percentage of approval in this course corresponding to the first academic semester on 2022 (202210) on a national level is 89,4%, similar to the academic period on 2019 (201910) which was 88,0% of approval, period in which different methodologies of teaching-learning were starting to be inserted. Is important to mention that students in this academic period had already realized high school education in online mood because of the COVID-19 pandemic, so the concepts of chemistry and mathematics, the collaborative learning and motivation were in decrease, therefore, to reach a good learning in this course, which is reflected in the percentage obtain by the students, which is owing to the different teaching-learning methodologies used.

Now, to know which perception have the students with the use of these methodologies, we carried out a survey.

Next, we will show the results obtained in the survey:

74% of the students manifest the pre-classes readings and readings quiz, as useful in the learning of this chemistry course.

93.5% of the students mention that the collaborative work realized in classroom (team quizzes) was useful to improve their process of learning with their partners.

82.6% of the students mention that the learning capsules used in this chemistry course were useful to their teaching-learning process.

Regarding to the learning capsules, 50% of the students use it to reinforce topics that were analysed in class, 41.3% just to study for a test, 6.5% use to study after classes and 2.2% to study right before the test.

74% of the students have a very good evaluation regarding to the methodologies use, considering the readings and reading quizzes pre-classes, quizzes realize in teams and learning capsules.

Finally, 80.4% of the students would recommend these methodologies to a partner for study on this course.

5. Discussion

As a discussion about this project related to the experience of learning is that the students could experiment a different way to the traditional one of learning chemistry, using collaborative work, flipped classroom and the use of learning capsules. Around 75% of the students manifest both pre-classes readings and reading quizzes were useful in the teaching-learning process; approximately 93% of the students mention that the collaborative work in classes was useful in the process of learning with their partners; 82% of the students mention that the learning capsules were useful in the teaching-learning process and 74% of the students appreciated very well this teaching-learning methodology.

Regarding to the methodologies used in this project were collaborative work where the students gather in groups of three, to develop a workshop that was fed back by a student of each group or by the teacher, also flipped classroom was used, where the students had to read a pre-class reading and answer a quiz; the other methodology was the use of learning capsules, where different resolve exercises were uploaded to the virtual classroom.

6. Conclusions

As a conclusion, the target was achieved “implement a methodology of active learning, collaborative and effective feedback in the basis of general and organic chemistry course in a career of the health care area”, performing a quality teaching-learning process, which is reflected in the percentages of approval of 89.4% and in the survey realized to the students where approximately the 85% of them mention that the methodologies used were useful in the teaching-learning process.

7. Limitations and future investigations

There are no limitations, and we will continue realizing investigations in the area of didactics in sciences.

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