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INNOVATIVE STRATEGY FOR THE IMPROVEMENT OF COMPETENCES IN THE AREA OF SCIENCE

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ABSTRACT

Objective: To design and implement a cooperative experience in the higher education institution in a subject of the Bachelor's Degree in Chemical Engineering carried out over five academic years.

Theoretical Framework: Higher education today calls for innovation processes that facilitate the improvement of student learning.

Method: A learning experience based on the Kolb cycle and the seminar was designed and implemented. The evaluation of the experience was carried out using the Learning Oriented Assessment (LOA) model, together with a questionnaire compiling the evaluations expressed by the students, according to the Likert scale.

Results and Discussion: The results revealed that students consider that the key to learning development lies in the distribution of tasks and the ability to work actively and autonomously.

Research Implications: The practical and theoretical implications of the study are discussed, providing higher education institutions with a learning strategy to improve competences in the area of science through innovation tools.

Originality/Value: This research highlights innovative tools that favour the development of the cognitive skills of analysis, critical thought, internalization of concepts and consolidation of part of the contents of the subject, without forgetting the communicative skills and self-learning of the student.

Keywords: University, Cooperative Learning, Evaluation, Innovation.

ESTRATÉGIA INOVADORA PARA O APRIMORAMENTO DAS COMPETÊNCIAS NA ÁREA DE CIÊNCIAS

RESUMO

Objetivo: Projetar e implementar uma experiência de cooperação na instituição de ensino superior em uma disciplina do curso de bacharelado em Engenharia Química, realizada durante cinco anos acadêmicos.

Referencial Teórico: Atualmente, o ensino superior exige processos de inovação que facilitem o aprimoramento do aprendizado dos alunos.

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Método: Foi projetada e implementada uma experiência de aprendizagem baseada no ciclo de Kolb e no seminário. A avaliação da experiência foi realizada usando o modelo de Avaliação Orientada para a Aprendizagem (LOA), juntamente com um questionário que compilava as avaliações expressas pelos alunos, de acordo com a escala Likert.

Resultados e Discussão: Os resultados revelaram que os alunos acreditam que a chave para o desenvolvimento do aprendizado está na distribuição de tarefas e na capacidade de trabalhar de forma ativa e autônoma.

Implicações da Pesquisa: As implicações práticas e teóricas do estudo são discutidas, fornecendo às instituições de ensino superior uma estratégia de aprendizado para aprimorar as competências na área de ciências por meio de ferramentas de inovação.

Originalidade/Valor: Esta pesquisa destaca ferramentas inovadoras que favorecem o desenvolvimento das competências cognitivas de análise, pensamento crítico, internalização de conceitos e consolidação de parte do conteúdo da disciplina, sem esquecer as competências em habilidades de comunicação e autoaprendizagem do aluno.

Palavras-chave: Universidade, Aprendizagem Cooperativa, Avaliação, Inovação.

ESTRATEGIA INNOVADORA PARA LA MEJORA DE COMPETENCIAS EN EL ÁREA DE CIENCIAS

RESUMEN

Objetivo: Diseñar e implementar una experiencia cooperativa en la institución de educación superior en una materia del Grado en Ingeniería Química llevada a cabo a lo largo de cinco cursos académicos.

Marco Teórico: En la actualidad la educación superior reclama procesos de innovación que faciliten la mejora del aprendizaje del alumnado.

Método: Se diseñó e implementó una experiencia de aprendizaje basada en el ciclo de Kolb y el seminario. La evaluación de la experiencia se realizó a través del modelo de Evaluación Orientada al Aprendizaje (EOA), junto con un cuestionario recopilatorio de las valoraciones manifestadas por el alumnado, de acuerdo a la escala Likert.

Resultados y Discusión: Los resultados obtenidos revelaron que el estudiantado considera que la clave del desarrollo del aprendizaje radica en la distribución de las tareas y en la capacidad de trabajar de manera activa y autónoma.

Implicaciones de la investigación: Se discuten las implicaciones prácticas y teóricas del estudio, proporcionando a las instituciones de educación superior una estrategia de aprendizaje para mejorar competencias en el área de Ciencias a través de herramientas de innovación.

Originalidad/Valor: Esta investigación pone en valor herramientas de innovación que favorecen el desarrollo de las competencias cognitivas de análisis, pensamiento crítico, interiorización de conceptos y consolidación de parte de los contenidos de la materia, sin olvidarse de las competencias en habilidades comunicativas y el autoaprendizaje del estudiantado.

Palabras clave: Universidad, Aprendizaje Cooperativo, Evaluación, Innovación..

1 INTRODUCTION

Innovation in higher education should facilitate the improvement of student learning, the professional development of teachers and even organizational improvement of the university (Hannan et al., 2005). The use of innovative tools in university classrooms implies a variation in traditional pedagogical practices, based on the expository methodology, by establishing the participatory character of students and new evaluation processes (Pérez-Robles et al., 2024). These new methodologies give way to team-built learning, in a collaborative, active and critical way (Díaz et al., 2014).

This work consists of the successive improvements of the proposals and experiences detailed in previous works (Herrera-Melián & Garcia-Jimenez, 2016; Garcia-Jimenez & Herrera-Melián, 2017; Carrasco-Acosta et al., 2018; 2019), which have materialized in an experience carried out at the University of Las Palmas de Gran Canaria (Spain), in the subject of Biology and Biochemistry of a mandatory nature. This subject is taught in the first semester of the third year of the degree of Chemical Engineering within the area of knowledge of the Sciences. This subject is considered by students as a discipline decontextualized in their curriculum, and, of little interest for their training as chemical engineers. Likewise, it should be mentioned that the entrance profile of the students shows that the training in the area of biology knowledge comes from compulsory secondary education (ESO). Hence, the design and implementation, in the context described, of an innovative strategy based on cooperative learning was proposed. In addition, this designed strategy provides students' assessments of the methodology developed and the acquisition of skills and involvement of the student throughout five academic years in the subject mentioned above and always taught by the same faculty.

The specific objectives that we propose are i) to design a teaching project whose curricular elements would respond to the basic approaches for the development of cooperative learning; ii) to implement the experience throughout the temporalization of the subject; and iii) to collect the assessments of the students participating in the experience.

2 THEORETICAL FRAMEWORK

The active participation of students in the learning process changes the way in which students and teachers interact in the classroom, reassigning the role of both as learning managers (Castilla et al., 2024), and, in addition, obtaining the final reflections jointly. Therefore, at present, it is necessary to collect information from students about the perception

they have of themselves during the learning process, and the preferences they have for one type or another of learning methodology. Possessing this information contributes to the improvement of students' academic results and the adoption of new practices and/or strategies, by the teacher, that optimize learning. Likewise, it must be taken into account that the process of learning of the students of the higher institution is complex and faces numerous inconveniences. Some of these disadvantages are the difficulty in understanding the tasks entrusted; the use of didactic strategies not suitable for learning; incidence in the memoristic study; the lack of connection between what was learned and the real situations; or the difficulty to work autonomously. Therefore, the role of the teacher is fundamental in the orientation and direction of student learning through the correct preparation of students to acquire competencies and make reflective decisions (Bonals & Sánchez, 2007; Imbernon et al., 2008; UNESCO, 2015) regarding how, when and where to develop the learning process (Noguero, 2006).

Consequently, the choice of one or another innovative tool is based on the type of students, the number of students and the elements of the curricular design such as the contents of the subject to be developed, the competences to be acquired by the students, the available didactic resources and the expected learning results (Noguero, 2006; Gallardo & Reyes, 2018). There are multiple strategies that are being used in higher education classrooms in order to promote the development of student learning. The most used strategies are those based on cooperative learning. Some of these most commonly used innovative strategies are the Puzzle technique (Aronson, 1978) or the Co-op co-op or flexible cooperative learning technique (Kagan, 1985).

Also noteworthy are those strategies that favor autonomous, critical and reflective learning such as the Kolb cycle (Kolb, 1984), collective intelligence, the methodology of triangulation in teaching (MTD) (Manero et al., 2011), or the inverted classroom (Bergmann & Sams, 2012). In this context, the Kolb cycle tool contributes to the student's learning process, favoring the implementation of their previous theoretical knowledge and experiences acquired, to achieve their professional training. We can say that the Kolb model (Kolb, 1984) establishes four different stages for the achievement of learning (experimentation, reflection, conceptualization and application), and the improvement of the dialog between students and teachers (Camacho et al., 2017). As we see, in the Kolb cycle the way students learn depends on how they perceive and process information after learning a specific experience (Puello et al., 2019). Combining cooperative learning with specific strategies such as the Kolb cycle, the acquisition of multiple competences by university students is achieved, such as: strengthening, deepening, debate and integration of content, facilitating the resolution of tasks, developing oral

expression, logical ordering of content and skills in the use of different sources of knowledge (González et al., 2013). In this type of experience, the teacher is responsible for creating the didactic resources that facilitate the autonomous learning of the students (Cepeda, 2018), being one of the keys of the process, the tasks to be carried out by the students (Jauregui et al., 2014).

3 METHODOLOGY

3.1 THE TEACHING PROJECT

The subject of Biology and Biochemistry consists of 4.5 credits divided equally between the areas of knowledge of biology and chemistry. The contents of the subject of biology are divided into three modules called environmental microbiology, industrial microbiology and biotechnology. Specifically, the implementation of the experience was carried out in the environmental microbiology module, during three sessions of two hours each. This module is characterized by having six hours of theoretical content and four hours of practical laboratory classes, which are divided into two sessions per group of practices, of two hours each. The set of sessions in this module of environmental microbiology represents 50% of the hours of the contents of the area of knowledge of biology.

The subject teaching project establishes that the specific objectives of the module are the recognition of different groups of microorganisms and the identification of biological and chemical problems related to the environment. In addition, it is specified that the transversal, nuclear and specific competences are: the capacity to make decisions, the resolution of problems, the critical reasoning and transmission of knowledge, the effective oral and written communication, the teamwork, the solvent use of the resources of the information, or the capacity to work in multidisciplinary environments. Indicate that the contents are directed towards the cellular organization and the different types of metabolism; the knowledge of the main environmental bioindicators and in the methodologies and procedures for their sampling; as well as, the knowledge of differentiating a bioindicator from a pathogenic organism; and, the knowledge of the different water quality regulations according to the uses of it.

3.2 DEVELOPMENT OF EXPERIENCE

In the first session, which lasted two hours, the teacher presented the contents of the topic in the classroom and later explained how to proceed to work on the topic planned in that

session. The teacher began by applying the Kolb cycle tool, following the stages of this methodology: experimentation, reflection, conceptualization and application. The objective of the experimentation stage was to guide students towards the introduction of the contents of environmental microbiology. The total duration of the session was 10 minutes. In this part, the role of the students is active in their learning process, while the teacher acquires the role of facilitator by encouraging the participation of their students. In this first stage of experimentation, a series of images were presented to the large group of students, allowing them to visualize them for 20 seconds each.

For the development of the second stage of the Kolb cycle (reflection) the relevant connections between previous experiences and knowledge in biology (observation and exchange of ideas) were established. In this case the teacher acquires the role of moderator of the debate, where in addition to guiding also promotes new issues to the students, while the students focus on their activity in the intervention throughout the debate reflecting and responding to questions related to the subject. As an example, the following questions were raised: what has happened; why do you think it has happened; where has it occurred; which agencies should intervene; or what prevention measures can be implemented. This reflective process allowed teachers to perform a diagnostic evaluation of the previous knowledge of the class group. In the third phase of the cycle, the conceptualization phase, the teacher assumed the leading role, since he must provide his students with a theoretical framework from the results of observation and experience. Regarding the timing, of the two phases mentioned, indicate that it was approximately 20 minutes. The last phase is implementation. Here the objective was to structure the topic around the contents treated. This stage ended with the presentation of a printed document of a scientific-informative nature selected by the teacher. With this choice, the teacher should favor the development of the following issues: bioindicators, regulations, and methods and procedures of microbiological identification. The students made a pooling, using the strategy of the brainstorm, taking as reference the main ideas of the document provided. The development of the activity was made by taking notes, either on the board or in the notebook, of those concepts or ideas that were extracted. The duration of this phase was forty-five minutes.

In order to use the advantages provided by cooperative learning, the teacher proceeded to organize his students into heterogeneous working groups, these groups being composed of five members. The teacher gave each group one of the topics that emerged in the brainstorm after the visualization of the images. From here, the teacher indicated the guidelines to carry out the oral presentation of the corresponding topic (organization of contents, didactic resources

and time of exposure), and explained the development of it. In this case, the evaluation criterion focused on each group of students posing at least five questions at the end of the presentation. At this point the teacher closed the session.

In addition to face-to-face work, the student had to carry out non-face activities, such as reading and analyzing printed documents (articles), which the professor previously posted on the University's Moodle platform. Once this task was completed, they proceeded to share with the rest of the members that made up their group. And it is here where they developed the design of the oral exhibition and the elaboration of five questions, which they delivered to the teacher before the exhibition. The questions posed by each group were part of the evidence of the work done. The role of the teacher was focused on supporting students, at the same time, resolving doubts or questions that may arise in the forum created on the platform.

The second session aimed to discuss, reflect and agree in the classroom the different exhibitions presented. The teacher's task was to present the rubric of the evaluation, clarifying the different aspects to be evaluated and the percentages applied. The time allocated to clarifications for the evaluation system by heading was 10-15 minutes. The rubric was posted on the Moodle platform so that the working groups could consult what aspects were going to be evaluated in their presentation. The order of the exhibitions of the topics was assigned by lot. The time allotted for the exhibition was 10 minutes with a subsequent debate of similar duration. The evaluation of the exhibition was carried out by both the teacher and the rest of the student groups. Each group was set up by at least three students randomly selected by the teacher. The rubric was provided to the student evaluators and they were given two minutes for their review. At the end of the exhibition, a turn of questions was opened to resolve those that were raised by the groups outside the one that exposed, or doubts that arose during the presentation. The qualification of the oral presentation was carried out taking into account four weights that had to be exceeded independently: i) the evaluation of the teacher; ii) the evaluation of the student evaluators; iii) the document of the questions, which was delivered before the beginning of the oral sessions (second session); and, iv) the co-evaluation of the teamwork. This note was individual for each participant of the group obtaining the same from a rubric that considers as evaluable elements: the punctuality, the assistance, the work entrusted, the quality and contribution of the work contributed, as well as the integration in the group.

The third session was divided into two parts. In the first part, an individual evaluable questionnaire of 10 short questions on concepts and aspects treated in the exhibitions was carried out. This questionnaire lasted a maximum of one hour. The second part consisted of evaluating the innovative experience, assessing: the advantages and limitations, as well as other

possibilities. The type questions that were included in this evaluation were, for example: what opinion this innovative experience deserves; what weight these tools would have against the expository class; you have recognized some improvement in your learning, etc. This provided information that allowed us to draw final conclusions agreed between the students and the teacher. The session ended with a survey of student satisfaction about the experience developed, where some of the questions collected were: if the time spent on the experience is excessive; or, what degree of interest you have aroused the activities carried out.

3.3 EVALUATION OF LEARNING

The proposed experience in the environmental microbiology module was planned according to a Learning Oriented Assessment (EOA) approach and evaluated through five assessment documents in which both the teacher and the students participate. All evaluation documents were mandatory to access the evaluation of the subject. All the evidence was registered in the Moodle platform of the subject.

On the part of the teacher, the evidence obtained, and that allowed him to evaluate the transversal competences defined in the rubric, were those provided by the evaluations included in Table 1. Specifically, 70% of the evaluation corresponded to the exposure of cooperative groups and 30% to the content questionnaire (Table 1).

Table 1

Weighting of each of the assessment activities of the environmental microbiology module.

Activity	Percentage of total assessment	Document	Points	Percentage of detailed assessment
Exhibitions in cooperative groups	70	Teaching rubric	1–10	20
		Rubric of the student evaluator	0-10	30
		Heading Co-evaluation*	0-20	15
		Question Paper	0-10	5
Content Questionnaire	30	Written test (10-question questionnaire)	0-10	30

*To access the evaluation, 60% of the group members must score at least 15 points.

3.4 EVALUATION OF EXPERIENCE

3.4.1 Sample

The experience was carried out during five consecutive academic years – 2016-17, 2017-18, 2018-19, 2029-20, and 2020-21 – where the teaching was taught by the same faculty. In the first year the sample was composed of 28 students, while in the 2017-18 and 2018-19 academic years the number of students was 32 and the last two were 24 students for the 2019-20 academic year and 23 students for the 2020-21 academic year. The first year sample was distributed in a ratio of 1:1 (student: student). These students had an average age of around 20-21 years and with about 80% of the enrolled credits, until that moment, exceeded. In the academic years 2017-18 and 2018-19 the gender ratio was 1:0.7 (student: student). The curriculum profile of the students corresponded to students who had exceeded 80% of the enrolled credits with an age between 20-21 years. By contrast, 2% of males had not passed those credits and the average age was 23-25 years. In the last two years, the sample was distributed in a ratio of 1:0.6 (student: student), with a more homogeneous curriculum profile among students, who had exceeded on average 85% of the credits enrolled and aged between 20-23 years.

3.4.2 Instrument

The evaluation of the experience was carried out through a questionnaire according to the Likert scale of 1-5, where it was inquired about the satisfaction of the students with respect to the methodological dimension, the competences worked on the subject and the involvement of the students in the experience. Regarding the methodology, the importance was focused on the activities developed, the dynamics of the classes and the role of the teacher. The competencies dimension was grouped under the sub-dimensions of task relation and time, and student autonomy. The involvement of students in the experience was delimited in the sub-dimension of protagonists of the training and differences between the methodologies received.

3.4.3 Data analysis

The analysis of the data had a relevant significance in relation to the study objectives, since it provided us with the information to improve the learning process developed.

Specifically, for the processing of the data, the programs IBM SPSS Statistics 27 statistical (IBM SPSS Inc., Armonk, NY, USA) and Statgraphics Centurion v.18 (Statgraphics Technologies, Inc., Virginia, USA) were used through a data matrix with the data of each student.

4 RESULTS AND DISCUSSIONS

Regarding student satisfaction with innovation methodologies (Question 1; Table 2, Figure 1) in the 2018-19 academic year, 85% of respondents with a satisfaction of 3.5 out of 5, score on the Likert scale, while 100% say that these classes are more dynamic and stimulating for learning than the expository class (Question 2; Table 2, Figure 1) with 3.9 satisfaction, coinciding these data with those reported for the 2020-21 academic year (Table 2, Figure 1). Instead, it should be noted that before the question of whether the teacher should explain the most relevant, since, the rest of the information must be sought by the student, 31% disagree in the 2018-19 academic year, and the general satisfaction is 2.2 out of 5, data similar to those reported in the 2020-21 academic year, where 39% disagree, with a satisfaction of 2.4 (Question 3; Table 2, Figure 1). In addition, this trend is also reported for the two previous courses (2016-17 and 2017-18) and the 2019-20 course, being notable that despite the preference for innovation methodology and the autonomous learning that entails, students prefer that the teacher teaches an exhibition class (Figure 1).

The assessment considering two competencies worked with this type of tools, such as autonomous work and organization, and personal management (questions 4 and 5, respectively; Table 2, Figure 2), shows that 70-92% of the students surveyed during the five academic years subject of study, understand that the tasks entrusted were well distributed in time (3.2-3.8 satisfaction; Table 2), as well as the effort for their correct development. Likewise, with a range of 75 to 83% (Figure 2) of the students asked during the entire study period, it was considered capable of working autonomously with a satisfaction of between 2.8 to 3.8 out of 5 (Table 2).

Table 2

Student satisfaction (Likert scale of 1 to 5) with respect to methodology, acquisition of competencies and student involvement with experience, during five academic years.

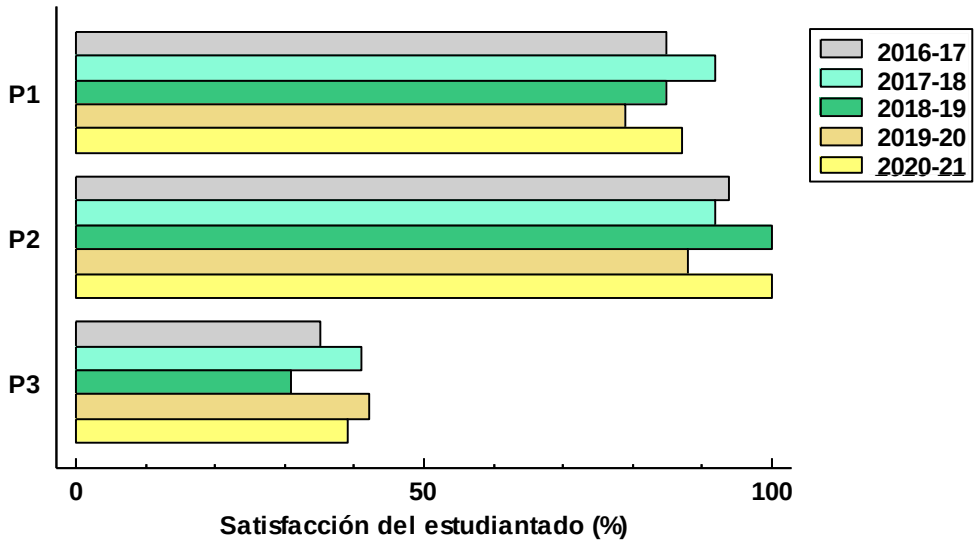
	Academic Courses				
	2020–21	**2019–20**	**2018–19**	**2017–18**	**2016–17**
Number of students	23	24	32	32	28

Question						
Methodology						
Q1	They prefer innovation activities to exhibition classes	3.5	3.3	3.5	3.8	3.6
Q2	Classes are more dynamic and stimulating for learning compared to the master class	3.9	3.4	3.9	3.5	3.9
Q3	The teacher must explain the most relevant, since the rest of the information must be sought by the student	2.4	2.9	2.2	3.1	3.3
Acquisition of competencies						
Q4	The tasks were well distributed over time	3.7	3.2	3.5	3.8	3.5
Q5	You feel like you are able to work autonomously	3.6	3.4	2.8	3.8	3.0
Student involvement with the Experience						
Q6	They feel part of their formation	3.7	3.5	3.6	3.6	3.0
Q7	Has the use of innovative methodology favored your learning?	3.7	3.0	3.3	2.9	3.3

In relation to the student's involvement with the experience (Questions 6 and 7; Table 2; Figure 2), 65-92% of the students indicate that they have felt participating in their training by improving this percentage in the last three academic years analyzed (2020-21, 2019-20 and 2018-19; Figure 2) and ≥95% of the students indicated that they have learned more, except for the 2017-18 course for which a decrease in the percentage of students according to question P7 was reported (65%; Figure 2). Student satisfaction ranged from 2.9 to 3.7 with respect to their involvement in the development of the experience (P6 and P7; Table 2, Figure 2), obtaining the highest satisfaction (3.7 out of 5), for this block of questions, in the last academic year analyzed 2020-21 (Table 2).

Figure 1

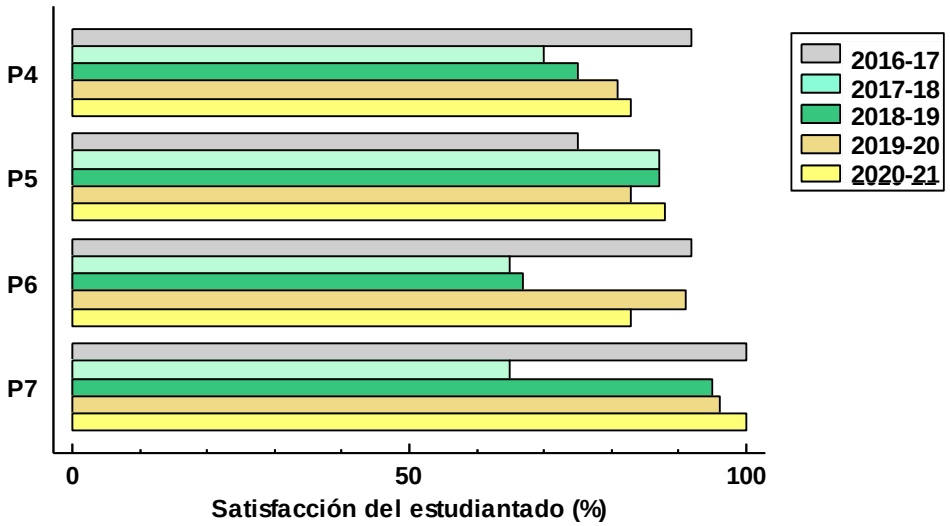
Student satisfaction (%) with the methodology over five academic years. Questions, P1: They prefer innovation activities to expository classes; P2: Classes are more dynamic and stimulating for learning compared to the master class; P3: The teacher must explain the most relevant, since the rest of the information must be sought by the students. 100%= 23, 24, 32, 32, and 28 students enrolled in the 2020-21; 2019-20; 2018-19; 2017-18; and 2016-17 academic years, respectively.



The results obtained allow to affirm that the students are in favor of the use of this type of innovative tools, although the results of satisfaction obtained, can indicate, in a certain way, that still the university teachers must make efforts so that the student is an active element in their learning process. If we compare all the experiences carried out, we find that the results have two important handicaps in common to obtain more relevant levels of satisfaction. The first of them refers to the fact that students pursue a technical career and are fundamentally accustomed to solving problems of different kinds, to those posed in the area of biological sciences. Secondly, students feel disoriented in the search for information, do not know how to discern between the generic and the particular, and care greatly about the final result.

Figure 2

Satisfaction (%) of the student with the competences worked for their learning through the questions P4: The tasks were well distributed in time, and P5: They feel that they are able to work autonomously; and with their involvement in the development of the experience through the questions P6: Do they feel participants of their training?, and P7: They feel that they have learned more with this methodology. 100%= 23, 24, 32, 32, and 28 students enrolled in the 2020-21; 2019-20; 2018-19; 2017-18; and 2016-17 academic years, respectively.



Although the final evaluation is based on 50%, corresponding to the evaluation of the students (30% comes from the evaluation by rubric by the student evaluators, and another 20% corresponds to a document of questions prepared by them; Table 1), the truth is that, they do not make use of self-criticism when self-evaluating, and the issues generated with the study and preparation of the questions raise the idea of the vague deepening in the subject by the students. This is especially relevant, since, in the 2018-19 academic year, for most students, the rubric evaluation is complicated, and the rest did not serve to self-evaluate.

Regarding the satisfaction of the students with the developed methodology we can conclude that they consider it optimal as a facilitator of learning, being the most dynamic and participatory classes than those where there is the predominance of expository methodologies. At this point we agree with authors such as Gallardo & Reyes (2018) when studying the learning relationship between teachers and teachers. However, even extracting from the results the interest shown by students towards innovative methodologies, at the same time certain contradictions are also presented. These are derived from the opinions that highlight the preference of the student to have fewer expository classes but that the role of the teacher is more

expository. This trend detected in all students under study is significant despite the preference for innovative methods and the autonomous learning that entails.

From the point of view of the implementation of cooperative work, as teachers we must question whether students will have an equal involvement and sharing of responsibilities; whether the activities are really designed to work in collaboration; or whether the abilities and abilities of the group members are balanced. In short, the teacher's previous work is to assess the pros and cons of the cooperative approach. Assuming that the answer is positive, it is convenient to highlight that the change in pedagogical practices must be made at all levels of the educational system, since the process focuses on students learning through the acquisition of the knowledge they need.

Likewise, self-employment, organization and personal management are important keys to the development of the subject. To highlight that the vast majority of students consider that they are able to work autonomously and thus improve their training. The data obtained coincide with the studies of García-Diego et al. (2018) and Caballero-Cantu et al. (2023) on self-regulation of the study of university students. Special relevance acquires the satisfaction of the students with the competences worked for their learning. Most participants in the study believe that the key lies in the distribution of tasks and the ability to work actively.

Similarly, the students, in relation to the involvement with the experience, consider that they have felt involved in their training and strongly believe that they have learned more. Flexible schedules and open training spaces for the development of learning activities is appreciable from a didactic approach (Area & Adell, 2009; Chávez, 2024).

5 CONCLUSION

The results of this experience carried out during five academic years show the same trend. The success of this innovative strategy depends on non-quantifiable variables such as the personality of the students and their previous educational experience. However, we believe it is necessary to reflect on the attitude of students to the dilemma of acquiring knowledge or passing the evaluation tests. It would be interesting to develop an instrument that allows us to evaluate the experience developed more precisely, in addition to being able to implement and evaluate this methodological experience in other areas of knowledge to contrast the results.

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