

## Problem-based Learning as Methodological Technique to Develop Critical Thinking

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### **Abstract---**

*An investigation related to the weak development of critical thinking is carried out in second year high school students of the Educational Unit "Quince de Octubre" in the canton of Jipijapa, so the objective was to analyze the contribution of problem-based learning such as methodological technique in the development of the critical capacity of Biology students. In the development of the research, 55 students from the Biology course were selected, who participated through the application of practical exercises using the Problem-Based Learning technique, which was worked methodologically following the learning cycle of experience, reflection, conceptualization and application (ERCA). To confront the results, a diagnosis was carried out where the level of development of critical thinking of the students was determined, to observe the achievements after the intervention, verifying that the technique helped students in the development of their critical thinking. The research is descriptive - explanatory, qualitative and quantitative methods were used for the analysis, making use of research techniques and instruments such as observation, test, survey questionnaire. As a result of the investigation, it was obtained that the students improved their capacity for analysis and criticality.*

**Keywords---***Critical thinking, Biology, Methodological technique, Problem Based Learning.*

### **Introduction**

Critical thinking has been practiced since ancient times, so it is not something new, many cultures show that it has been studied in order to build the truth, in this publication it has been done with teachers from various countries to Validate the importance of putting thought into practice, establishing that there are different types of thoughts that we start every time we decide something, but the most outstanding is the critical one because it allows us to apply new knowledge (Bezanilla, Poblete, Fernández, Arranz, & Campo, 2018; MIMOUNI, & Tamer, 2020; Chowdhury, 2020).

It is essential that students are not only recipients of information and memorize, although it is difficult for them to give reasoning with their own criteria, for this reason tools that develop critical thinking must be provided, which they can decide on their environment, taking into account the knowledge acquired throughout their lives and can resolve any situation that comes their way. Therefore, as teachers we must apply new teaching methodologies so that they are productive people and not only beings who obtain information, comprehensive teaching must be promoted, where social and psychological factors are considered as part of learning (Matamorros, 2018).

In Latin America, the fact of thinking, of being able to string together ideas and their criticality is obtained as a result of the action or effect that the subject performs, whether for the benefit or harm to society, being historical-social practices that involve the training of the thought, trying to differentiate it from knowledge based on reality and not on a utopia. (Acosta, 2010)

Critical thinking is forged as intellectual thought, disciplined to conceptualize, apply, analyze, synthesize and evaluate the information gathered from observation, experience, reflection, reasoning or communication (Ávila, Olivares, & Olivares, 2017). Being a process that aims to reason, understand and evaluate the way in which they are organized wisdoms that are intended to be elucidated and personalized in the world, in particular the opinions or statements that in daily life are usually accepted as true.

In Ecuador it has been studied by various universities through degree work or scientific research, in which they have described it through a process that allows expanding their definitions and types of thinking that are similar but with different characteristics to critical thinking, building mental processes, synthesis and critical evaluations of what he perceives and learns, makes people more curious and captivated in their research, obtaining results with greater precision when solving a problem. (Mackay, Franco, & Villacis, 2018)

Critical thinking is identified by managing, mastering ideas, reviewing them, evaluating them and rectifying what is processed, understood and communicated through the different thoughts (mathematical, logical, verbal, others). The student is able to think for himself, according to his knowledge, aptitudes and own experiences. Critical thinking is one that allows us to elucidate the truth through the knowledge gained, the experience gained, the same in its beginnings the first students were in medicine and electromechanical engineering, then it expanded to other areas such as secondary and university education, also In other careers, Problem Based Learning gives optimal results (Olivares & Heredia, 2012).

In this line, problem-based learning (ABP) worldwide maintains as its main axis that students are the generators of their learning, a critical part of which is critical reflection, inquiry, debate, information search and conclusion, Being essential elements to solve problems of your daily life, since questions can be asked and answered to solve any difficulty, linking these characteristics to critical thinking.

It is considered a methodological technique that focuses on research and analysis on a problem posed, requires the student to be the manager of their own learning, who seeks the solution to problems, where the content to be studied and the role of the teacher are secondary elements (González & López, 2008). Where the roles of teachers and students change, where students have more responsibility in the learning process, while the teacher becomes facilitator or coordinator of the learning process, giving facilities to develop their skills and find solutions to the problem raised.

In Latin America, problem-based learning (PBL) becomes the review center, since all knowledge is learned and perfected with practice, where it includes planning, organization, coordination, direction and control, management, and therefore They create leaders who solve problems with scientific evidence (Cortina, Ortiz, & Expósito, 2015). Allowing to focus learning on the student, agreeing to interrelate different academic disciplines since students need to obtain knowledge of various subjects integrating learning and knowing how, using all this in the future in their professional life (Fernández & Duarte, 2013).

Several studies have been carried out with problem-based learning (APB), such as theses, articles in different places in Ecuador, where this model is evident as an innovator, where students must use certain knowledge in order to solve problems due to their cognitive capacity raised by the teacher, for being part of the constructivist model where knowledge and skills are valued (Reinoso, 2018).

It has been used in medical studies to improve the quality of medical education and in pedagogy as an innovative strategy for being more integrated and organized in everyday problems where different areas of knowledge influence during the teaching-learning process where future

attitudes are fostered professionals (Fernández & Fonseca, 2016). For everything manifested through Problem-Based Learning (PBL), it seeks to stimulate thinking, critical capacity, decision-making, to obtain better results in the face of any problem, it is no longer just acquiring information, but also training professionals who can solve its drawbacks, adapt to any environment and be more competitive.

There are many definitions of Problem-Based Learning (ABP), the one considered most successful is collaborative learning because student criticality is fostered by leaning on creativity, finding solutions, or interpreting the object of study through self-directed individual work. or tutored groups to combine wanting to be and wanting to learn, promoting attitudes and skills for the professional field (Martínez, García, Caso, Fidalgo, & Arias, 2006).

Given the advances in technology and information that is available to everyone, the use of ICT in education, **it** is necessary to change paradigms that help improve education to obtain people with other perspectives of change, since we have changed until the way to communicate, students must be prepared to enter a different work environment than the one demanded by the labor market, where they must solve complex problems and can decide with their own criteria and give good results (Morales & Landa, 2004).

It is a priority to change methodologies to improve education in students, that is why I have considered working with the Quinceoctubrina community, through its objective, which is to analyze the contribution of the problem-based learning technique to the development of the critical capacity of students of Second Unified General Baccalaureate in Biology.

## **Materials and Methods**

The ways in which the teachers of the Second Unified General Baccalaureate in the Fiscal Education Unit “Quince de Octubre” apply Problem-Based Learning in the subject of Biology, whose research is descriptive - explanatory, were used to analyze the methods. qualitative and quantitative, using research techniques and instruments such as observation, test, survey questionnaire as the problem is described and how the problem-based learning process behaves from a qualitative point of view. The used analytical inductive-deductive method was that will allow the investigation problem to be appreciated from the general to the particular and vice versa, being able to reach concrete conclusions on the subject studied, collaborative or group work was carried out to put the knowledge into practice, conducted a bibliographic review on the internet of the available material on the subject under study. The studied population is made up of 200 second year students of the Unified General Baccalaureate.

## **Analysis and Discussion of Results**

This ABP teaching-learning technique emerged with its first applications and development in the medical school at Case Western Reserve University in the United States and in the mid-1960s in Canada, changing the traditional structure of teaching learning, in that the teacher was the one who oriented the subject to study, then proposes some activities to be carried out, with Problem-Based Learning (ABP) the knowledge is first acquired to build scientific thinking through the problem statement, being the student who must develop skills, capacities, and abilities to solve problems through teamwork, developing synthesis, argumentation and reflection.

The ABP is part of the constructivist model where the students build their learning with a positive attitude and dynamic action from a problem whose students have to give a solution, it can be through inquiry, questioning, experimentation or essay (Walls , 2016). It is considered that students can be located to learn better when they discover and manipulate information by themselves instead of being only receivers of information by the teacher, allowing them to

capture the following skills: problem solving, decision making, work teamwork, argumentation, science-based reporting, management of attitudes and values.

Among its characteristics is that the student is the main actor, it is carried out in group or cooperative work, teachers are guides in the teaching-learning process, the problem statement becomes the stimulus of learning, problem solving allows to expand skills, learning is obtained through self-directed learning.

Learning through ABP, the process is progressively valued and can be guided or not; for the teaching resources and organization, but more for the interest they have to learn, motivation to obtain knowledge with active techniques with effort and perseverance to acquire new skills integrated by the elements are: the problem, the group, the teacher or tutor (Cortina , Ortiz, & Expósito, 2015).

This ABP teaching technique allows students to develop their criticality, group work by sharing information with their peers, identifies the needs to satisfy relevant information to solve their own problem and self-evaluate their self-learning, learn by doing, researching and mixing the cognitive with practice. For the decade of the nineties they define it as self-regulated judgment formation where cognitive skills are included: interpretation, analysis, evaluation, inference, explanation.

The use of the ABP requires an integrated curriculum, in order to create an active, renewed and self-directed learning, where the student learns of its context by doing cooperative work, solving the problem obtaining better results with this technique because the theoretical part is worked as practice (Latasa, Lozano, & Ocerinjauregi, 2012).

It seeks to gain the interest of the students and lose passivity in the classrooms, reflected in current study habits, therefore it seeks to motivate them with new forms of teaching - learning and through active methodologies, where experiences play an important role, relationships, the discipline that have been part of the formation of their personality (Valera, 2016).

Problem-based teaching is based on the abstraction, acquisition and management of information, understanding of complex systems, experimentation, cooperative work, where a problem is presented to the student, the same who assume the role of problem solver, while teachers They assist in fulfilling the role of tutors and coaches, where it is possible to relate the curricular content to situations in the student's life or simulated situations, it is important to bear in mind multidisciplinary activities and constant self-evaluation (Diaz, 2005).

As the ABP has been exposed, it is a didactic technique that not only deals with the objectives of knowledge; Rather, it seeks to develop skills and competencies so that one can work collectively and obtain better results, through the search and validation of information and communication. The technique has a pedagogical approach to support the self-learning of students, who select the relevant content or topics and self-training to later find the solution to problems posed, it can also self-evaluate their learning and acquire skills, competencies and attitudes, promoting collaborative work (Boude & Ruiz, 2009).

The ABP goes hand in hand with critical thinking as it seeks to train autonomous students who forge their own learning, who are probing, selective in seeking information to improve their cognitive skills and abilities. It is intended that students not only socialize in the classroom and also learn, some students are only interested in passing without having an idea of the knowledge that is important to their life, they lack motivation, they have not awakened challenges in their studies, no They have taken the opportunities to reflect and explain their own attitudes and dogmas, they show apathy to the routine classes so they only attend to meet their parents and the institution.

Critical thinking is characterized by its cognitive abilities, its disposition and how it copes with changes during life, this means that we work to improve their skills and ways of life, they have a broad sense of being well informed, innate curiosity, confidence in their investigative process, open mind to different events, flexibility to consider views and opinions of your peers, understanding of other people's opinions, impartiality to peer judgments, honesty for yourself and others. Other aspects that characterize a critical thinker: clarity in his hypotheses, discipline in his complex works, he must be thorough and sensible in the search and selection of information, perseverance in stressful situations, knowing how to take advantage of these qualities.

For the student to work with this ABP methodological technique, they must have an adequate environment so that they can express themselves, developing their critical thinking with clarity, reflection, empathy and they can have an open evaluation with problems that they can solve more rationally according to their knowledge and skills, achieve greater success as a person, therefore be happy with what they do every day in personal and professional life. This methodological technique revolves around a well-drawn problem, with a motivating topic for students and whose solution allows the advancement of the skills they want to promote (Fernández & Duarte, 2013).

At the secondary level there are few validation instruments that scientifically support the most critical capacity has been given at the university level, which is why it is considered a fundamental obstacle in the educational system to promote critical thinking in students, it is considered that it is not easy Evaluate it and much less measure it at the secondary level, so it is proposed to implement active methodologies to gain the interest of the student body, to meditate on the content to be taught in the class, to search for information according to the interest and age of the student, change of roles, where the teacher helps channel ideas to the class, asks questions that promote their interest and have an active class, the main actor in the class is not the teacher but the students.

Another way is to use previously planned cooperative work, is to choose as guides the students who master the subject, allowing them to learn from each other with vertical-horizontal communication between students and teachers, making it possible to evaluate through the ABP and their criticality through direct observation and creating skills in the branch to study, specifying the progress of the students and that they not only prepare them for the evaluations, but also assess their progress. Individualized interviews can be carried out to check the progress between students and parents, revealing their strengths and weaknesses, their portfolio can be evaluated from its presentation to its content and the class headings, promoting the reflection of the progress of critical thinking as validation scientific knowledge. Table 1 shows ways in which another author measures critical thinking.

Table 1. The critical thinking skills

<b>ABILITY</b>	<b>DESRPTION</b>	<b>ACTIVITY</b>
<b>INTERPRETATION</b>	Understanding and expression of meanings of experience, situations, events, judgments, beliefs, rules, procedures, etc.	Categorization, decoding of meaning, clarification of concepts.
<b>ANALYSIS</b>	Identify the inference reactions between statements, questions, concepts, expressions, etc.	Examination of ideas, detection and analysis of arguments.

<b>EVALUATION</b>	Credibility of what is established or of other representations such as the description of a person, perception and experience, situations, judgments, beliefs or opinions; evaluates the inferential relationships between statements, questions and concepts, expressions, etc.	Assess the credibility of demand and evaluate the quality of arguments that are used and induce or deduce reasoning.
<b>INFERENCE</b>	Identify and ensure the elements that are required to create a reasonable conclusion, form conjectures and hypotheses; consider relevant information and deduce the consequences from data, evidence, beliefs, judgments, opinions, concepts, descriptions, etc.	Consulting tests, conjectures of alternatives and obtaining a conclusion.
<b>EXPLANATION</b>	Consistent representation of the results.	Description of methods and results, justification of procedures, objectives, and conceptual explanations, argumentation, etc.
<b>SELF-REGULATION</b>	Self-conscious monitoring cognitive activity. Analysis and evaluation skills are used.	Includes self-examination and self-correction.

Table 2 shows the individual generic skills questionnaire-adapted critical thinking section

Table 2. Individual generic

DIMENSIONS	ITEM
Data analysis and interpretation	<ul style="list-style-type: none"> <li>● I panic when I have to deal with something very complex.</li> <li>● I can make comparisons between different methods or treatments.</li> </ul>
Judgment in a specific situation, with objective and subjective data.	<ul style="list-style-type: none"> <li>● I prefer to apply a known method before risking trying a new</li> <li>● I can explain in my own words what I just read.</li> <li>● 4.-I use my common sense to judge the relevance of the information.</li> <li>● 5.-I prefer evidence-based information to my personal perception.</li> <li>● 6.- I express innovative alternatives despite the alternatives that I can generate</li> </ul>
Judgment in a specific situation, with objective and subjective data	<ul style="list-style-type: none"> <li>● I am able to give the solution, although I do not have all the information.</li> <li>● Despite the arguments to the contrary, I hold firm to my beliefs.</li> <li>● Distinguishing real facts and prejudices</li> </ul>
Inference from the consequences of decisions based on self-regulated judgment	<ul style="list-style-type: none"> <li>● I base myself on possible consequences for solving problems.</li> <li>● Most of the time I am able to immediately consider all the aspects that affect a problem.</li> </ul>

Source: (Olivares et al., 2013)

In table 3, it the observation guide is shown for the skills of critical thinking based on the ABP

Table 3. Observation Guide for the skills of critical thinking based on the ABP

Ability of critical thinking	valuation level		
	High (1)	Medium (2)	Low (3)
Analysis	Identifies inferential relationships between statements, questions, concepts, etc. Examines ideas and is able to detect and analyze arguments.	Partially identifies inferential relationships between statements, questions, concepts, etc. It examines ideas and is able to partially detect and analyze arguments. It does	not identify inferential relationships between statements, questions, concepts, etc. It does not examine ideas and is unable to detect and analyze arguments.
Evaluation	Your information contains scientific and updated bases. Evaluates the quality of arguments based on the information collected.	Your information contains scientific but not updated bases. Partially assesses the quality of arguments based on the information collected.	Your information does not contain scientific bases or updates. Does not evaluate the quality of arguments based on the information gathered.
Explanation	Consistently represents the results, describes and justifies them. Make conceptual explanations and arguments.	Consistently represents the results, partially describes and justifies them. Make conceptual explanations and arguments partially.	It does not consistently represent the results, nor does it describe and justify them. It does not make conceptual explanations and arguments.

Source: (Facione, 1990).

Several work sessions can be done to develop this ability in children and young people, the results of which can be mediated through group workshops where research and the formulation of hypotheses against data are guided, reflecting the skill of argumentative analysis, the skills of evaluating arguments and verbal reasoning, and finally probability and uncertainty that is already related to decision-making (Jaimes & Ossa, 2016).

Through the ABP teaching technique, you not only want to obtain knowledge, but the integral development of the human being in training, allowing you to identify learning objectives, motivate and commit to your learning, discover and rediscover new knowledge, seeking to seek more information on the subject. , achieving the teacher to stimulate leadership, improves communication between peers and allows decision-making without the teacher's endorsement, fosters creativity, critical thinking and teamwork (González, Carbonero, Lara, & Martín, 2014).

Our proposal is to work with the ABP technique through the ERCA methodology (Concrete Experience, Reflection, Conceptualization and Application) in the field of Biology in the Fiscal Education Unit "Quince de Octubre", given that in the workshops held, the introduction of the topic, brainstorming to activate new knowledge, a reading to analyze it, the conceptual part was explained, carrying out an activity by the students and closing the activities. The materials were also prepared by the tutor and the students looked for news on the internet, sheets with questions and observation records were prepared by the students.

Learning by performance criteria of this ERCA methodology (Concrete Experience, Reflection, Conceptualization and Application) allows them to plan classes daily, it is also based on Piaget's theory and the learning model proposed by David Kolb in 1984, It is considered one of the most easily understood strategies for students.

Considered that it is a didactic methodological strategy that consists of four phases such as experience, reflection, conceptualization and application, which must be put into practice by the teacher, so that students develop skills and abilities allowing them to achieve the teaching-learning process. , it is important because it helps to develop new knowledge, abilities, skills, and create changes in attitude in students. They are processes of meaning construction where new information and experience are incorporated into the mental structure and become part of memory. comprehensive. (Parra & Pozo, 2017).

The ERCA methodological strategy allows students to explore, question, doubt and criticize their own perceptions and extract their own meanings from these experiences, so teachers can understand their students from their own points of view to improve the effectiveness of teaching.

For which the content to be taught in the Biology subject to work is planned in advance, to be carried out through the ABP in the ERCA stages and to evaluate the result of the technique and verify what has been learned, as well as go improving and exercising control of the methodology.

The ERCA methodological strategy allows students to explore, question, doubt and criticize their own perceptions and extract their own meanings from these experiences, so that teachers can understand their students from their own points of view to improve the effectiveness of teaching.

Among the advantages of ERCA related to the ABP: it presents real situations that can involve the student more actively in the learning process, allows observing and practicing new sciences to clarify topics, emphasizes that the instruction is meaningful either in a team or individual, develops interest through experience through the relationship of previous knowledge with new ones, it is a cycle that gives learning by skills, provides the opportunity to participate and reflect on the subject of class to students, allows the construction own ideas.

During this research to improve the teaching-learning process allows them to achieve and create knowledge through the development of learning, strengthening basic, specific and scientific skills through ABP as it is one of the active teaching techniques that allow learning for discovery and construction that contrasts with traditional techniques (Guerrero, 2019). Teamwork is valued and the master class is left aside, allowing students to discover and build new knowledge in the experimental area by solving real or fictitious problems by themselves, for which activities organized in didactic sequences and strengthen scientific competences that will then be evaluated through formative evaluation.

During our process of putting into practice the didactic technique related to the ERCA, the following was achieved: In the **experience** in the implementation of the ABP in the subject of biology, a real problem related to the subject of the class arises to be solved by means of team work. During the **reflection** to solve the problem posed, sources of information of different kinds are sought and where the points of view are discussed to arrive at a critical analysis based on the ABP. With **conceptualization**, consensus is reached and one or more responses to the problem posed are established, establishing a scientific basis on the subject.

Finally, with the **application** you can control and evaluate the technique in the field of Biology and make a reinforcement to improve the following classes with the students working with this learning technique, since the problem is a means to obtain knowledge and improve attitudes in students, the expected results were achieved.

The curriculum strategy of the ABP, it helps the activation of the multiple areas of development nearby, by observing the interaction and group consensus as a cognitive resource to promote learning, achieving individual responses and students can be developed in a group way, according to this study facilitates the teaching-learning process allowing it to solve complex problems and promotes some skills in teaching in the apprentice (González, Figarella, & Soto, 2016)..

The verified study on active techniques shows that teachers work with teaching strategies such as: group work, problems, projects, workshops, peer mentoring, classroom research, great efforts are made for students to learn, however there are several factors: ignorance of cognitive, effective and metacognitive processes that makes teachers not achieve concrete all required learning (Bravo & Varguillas , 2015).

The results show that students trained with ABP can achieve higher levels of evaluation, compared to traditional techniques, improves the development of critical thinking, using analysis skills, inference and the most important considered to evaluate (Nuñez, Avila, & Olivares, 2017). As a result of this study the ABP manages to develop critical thinking by favoring learning to learn that relates to selective memory, learning to do related to conflict resolution, learning to live together through cooperative work and learning to help in the student where judgment, autonomy, respect, responsibility is encouraged.

Training students by competencies that means the combination of attributes in students that will have to perform at the completion of a learning process, being an opportunity to implement active methodologies, allows a more colossal and adjusted learning in the student, where the student learns by his motivation, by his effort and perseverance (Cortina, Ortiz, & Expósito, 2015).

The ABP teaches students the theoretical content to work with cases based on reality, allowing the observation and analysis of attitudes and values that are the fundamental part of this learning technique that is useful since it trains future professionals who make better decisions in the daily work (González & Navarro, 2010).

Through this methodological technique better results were obtained compared to previous years that other techniques were applied, although there were difficulties since the student was accustomed to traditional teaching strategies, in the qualitative part there was a great advance in this form of learning and in the quantitative part was minor given to different obstacles that presented throughout the subject and the lack of technological resources , but helps the student to perform better (Latasa, Lozano, & Ocerinjuregi, 2012).

Emphasis should be placed on the development of social skills, to prevent school absenteeism due to lack of motivation or socioeconomic factors, ABP through interpersonal relationships promotes emotional intelligence such as social skills allowing to be able to express emotions in more appropriate ways by perfecting their attitudes, skills and school performance within the classroom, restoring aspects such as stress , anxiety in school, vocational maturity and optimism (Luy, 2019). I record that the integration of knowledge is achieved in the proposed subject by hypothesizing that can be verifiable and can infer between reality and what is indicated in the theory being a complete and entrepreneurial learning.

Group work was carried out during the month of March with the students who were in a supplement, surveys authorized by the highest representative of the secondary institution were completed, some teachers were interviewed on the knowledge of the ABP, direct and indirect observation was made on the progress of the learning teaching process in this way the work done with the rush of time is what was achieved.

During its execution in the classroom in the Fiscal Educational Unit "Fifteen of October", the content of Biology to work as they were plant physiology was planned, to execute it through the ABP in the stages of the ERCA was able to implement all the steps with the two parallels that carried out this learning and manage to evaluate the result of the technique and verify what has been learned, results were obtained at the beginning low, then intermediate and as well as improved until we could exercise a control in its entirety of the methodology.

The ABP and its influence on critical thinking forces us to think differently, it is to think about action and not in imaginary facts, for its execution, ratifying the processes of reasoning, decision-making processes that go hand in hand with the resolution of the problem posed, within the teaching is from the reality that is lived, deduction, induction, logic and argumentation (Saiz & Fernández, 2012). This technique allows us to identify aspects that can be improved in the way we think, improve academic performance and way of life.

The ABP was worked in small groups maximum 8-10 with a facilitator tutor, who together pose a problem to build a new learning using real cases to start the teaching-learning process based on the criticality until reaching the results, it is estimated that a way to learn effectively since skills develop, training in development of learning considering age and level of knowledge, allowing several hypotheses to reach the solution (Sepultera, Cabezas, García, & Fonseca, 2019).

From the beginning what is sought with the ABP is to improve the quality of education with a more integrated and organized technique to propose answers to real-life problems, being an active learning mode developing skills, skills and competencies in students through self-employed and team work, students must achieve the objectives set in the predicted time (Fernández & Fonseca, 2016).

The learning process through ABP is seen as the most significant educational innovation in the education of professionals for multiple advantages that it possesses: it provides opportunities for the student to evaluate what he knows and discover what he wants to learn, improve interpersonal and communication skills, allows to establish and defend positions with solid argument and evidence, allows the student the most flexible assessment and according to reality, forces himself to look for more information that meets his expectations outside of class without the help of the tutor (Wall, BLasco, & Colomer, sf). Processes are evaluated and the learning results, content, student research capacity, activities to be performed are evaluated, is considered from the particular to the general.

The ABP working sessions are composed of tutorials where teachers and students build learning in a collaborative context through discussions, debate, analysis, synthesis, arguments, exchange of opinions identify the problem, hypothesis is raised, learning objectives are developed, identify resources, individualized research, process evaluation and results, motivating teamwork for a common task, promoting self-learning (Navarro & Zamora, 2014).

It is essential that research in the ABP is not only bibliographic but that students seek to enrich themselves with the experience of other teachers or people around them through the use of techniques: direct observation, interviews or surveys, being aware of the reality in which they live through the problems investigated enrich their learning. (Paineán, Aliaga, & Torres, 2012). Argument that although the students are the protagonist of their learning, the teacher becomes the moderator, so it is essential to know well the subject and the teaching technique, because he is the person who guides cooperative work, supports the groups, guides scientific research, stimulates in team thinking, so the teacher is considered a mediator among knowledge, the information and the problem that is faced.

ABP is considered a pedagogical and curricular strategy that assumes the problem as a fertile area to learn, allowing the student and teacher to rethink the cognitive process and knowledge,

overcoming passivity in classrooms by interacting with the actors by appropriating their formative process (Pérez, 2019). Enabling the student to be a manager of new ideas to manage their learning, managing to have greater value for the student because he is an active participant in his academic training and to lay the tools for professionalization, training to perform better in the daily life with his fellowmen, the student is facing a process of teaching critical thinking.

The ability to argue, hypothesize, make probability judgments, deduce or solve complex problems well, it is appreciated that critical thinking helps the student to have these skills by achieving a process of finding knowledge through skills such as reasoning, finding problem solving, making decisions, obtaining greater efficiency the proposed results (Saiz & F.Rivas , 2008).

The ABP is a current trend of great impact on education emphasizing cognitive as the experience in the development of personal interests in students, combining by teamwork, solidarity and autonomy, allowing decentralization of knowledge and multidisciplinary it (Travieso & Ortiz, 2018). Agreeing that it takes advantage of the experiences acquired by the group, using means and pedagogical resources of technological mediation such as emails or discussion forums, assessing the capacities of each of them, the guide of the tutor teacher, the support of parents, seeking to elevate the rigor and efficiency of the educational process and insert to society people with a new paradigm and therefore with other life perspectives.

The ABP trains students developing the capacity for research throughout their life, with permanent self-motivation, obtaining not only knowledge but retaining it for longer, developing their capacity for analysis and synthesis of information, encouraging constructive criticism, improving interaction in individual and group work, perfecting peer communication, fosters a proactive attitude to learn by forming a quality thought that accompanies the professional life of the person in the process teaching-learning (Vera, 2016).

ABP is the teaching technique that develops more competencies compared to other developing techniques as mentioned above: critical thinking, self-direction and teamwork.

Critical thinking is defined as self-regulated judgment helps develop cognitive skills and self-motivation that includes: analysis evaluation, inference, explanation and self-regulation (Olivares & Heredia, sf). According to the authors, the first three sub-scales included in the test represent the basic skills of critical thinking, shown in Figure 1.

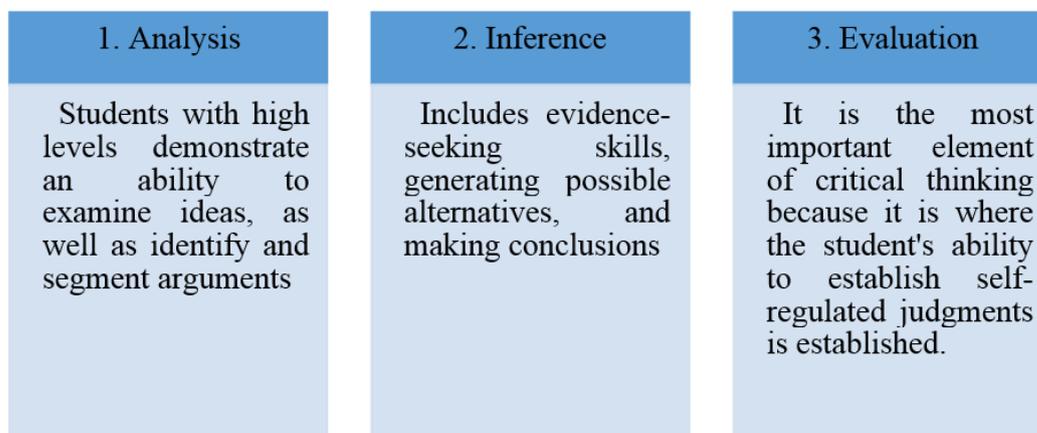


Figure 1. Basic critical thinking skills

It worked with second BGU students with a sample of 55 students in groups of 9 students in approximately 3 groups per course in two parallels in the Tax Educational Unit "Fifteen of October", at the beginning it was difficult while the technique of the ABP was known and

inserted into the ERCA methodology, several secessions were worked at the beginning with low results and from there it was increased to good results in this modality as detailed in Table 3 and the figure 2 respectively.

Table 3. Technical application sessions

Description of activities	Mode	Time
Organization of work team (3 teams) role assignment (leader, secretary and participants)	In class hours	90 Minutes
Research of what is known and not known	Extra class	Variable
Discussion of the information collected. Formulation of learning objectives, first as a team and then in consensus with the group	In class hours	80 Minutes
Research and study of the information needed to meet the objectives of study	Extra class	Variable
Presentation of information elaboration, of conclusions by teams. Conclusion in a group way	In class hours	80 minutes
Integration of the document to be evaluated	Extra class	Variable
Document delivery and post test delivery	In class hours	80 minutes

Muy buena actitud del grupo, todos cooperan. Presentan disposición para realizar la actividad.

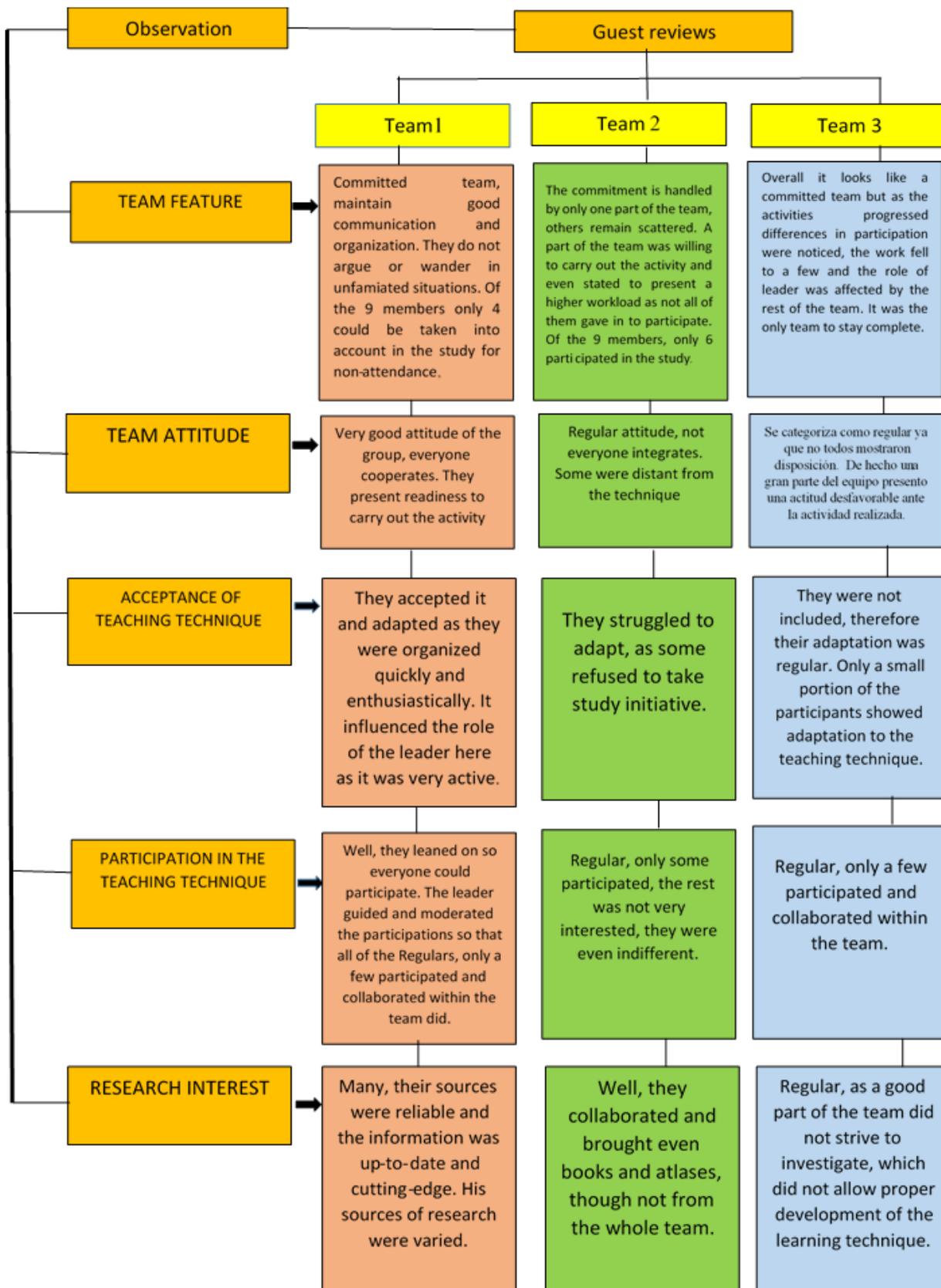


Figure 2. Team observations during the development of the ABP

The results of critical thinking skills are shown in figure 3.

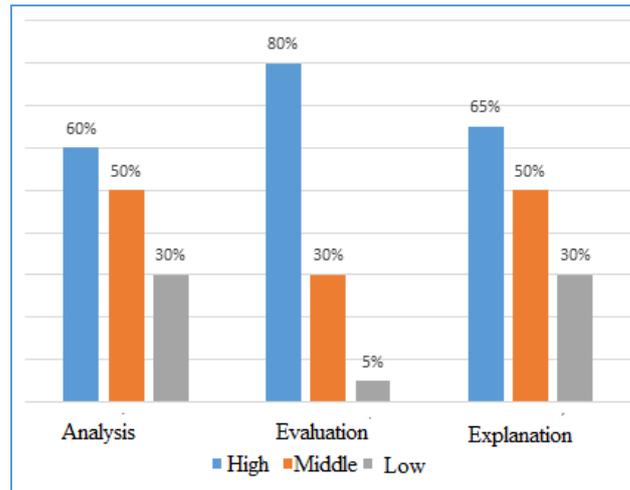


Figure 3. Critical Thinking Skills

In this work the thought skills valued as high in this course are similar in the two parallels, for those only a single table was made, giving good results in the analysis, evaluation and explanation, thanks to the leader who was able to guide the group managing to solve the problem, achieving the participation of all those present in this team, having a good performance in the ABP.

In the second team their performance was intermediate and the third team was regular since not all students participated and joined the technique, many worked individually, some were not motivated, the leaders tried to participate all the members but did not succeed, regular performance with the ABP.

The results show that the ERCA methodology mixed with ABP had good results in the subject of biology, there are more questions on the part of the students, investigate more on their own and bring new contributions to the class that has become more active, the teams work independently and their work has improved considerably, and gradually the difficulties are being solved and adapted to the technique is gradually what has been possible observing, better willingness for group work and conclusions with scientific basis result in, being able to make inferences, declare arguments, check the facts exposed in a large percentage.

It is important to continue to strengthen ABP within the ERCA methodology continuously to further improve outcomes by motivating them to use this teaching technique throughout the school year and thus continue to achieve better results throughout the learning cycle at the participating institution.

## Conclusion

Working with innovative techniques in teaching - learning of ABP, allows the active participation of students, developing skills and skills tailored to how it learns with the methodology, including this technique that we have worked on, where critical thinking forms apart fundamental, allowing problem solving and hence knowledge.

Using pedagogical technique such as ABP has greatly helped social development and emotional intelligence, helps in the development of activities in the classroom, because the fear of public speaking, having self-judgment and defending arguments with posture and scientific basis is lost. The research can claim that ABP favors competences, fostering leadership, mastery of the subject worked, know-how, know-how, criticality, judgment, analysis, reflection, synthesis, interpretation and inference and critical thinking in a large percentage since it is very important to master the active techniques of learning teaching.

The role of the teacher in having an active class is a daily challenge, for which we must constantly innovate, looking for useful tools to consolidate the learning that must be of impact for students both personally and academically, encouraging skills so that in the future they are professionals with new ways of thinking and acting on the problem of daily living.

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