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THE CLASSROOM INVERTED IN THE TEACHING-LEARNING PROCESS OF NATURAL SCIENCES IN TIMES OF COVID-19

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ABSTRACT:

The health pandemic, product of Covid19, is one of the most worrying crises that it is going through Humanity, in addition to being a health crisis, is also economic and social, leading the inhabitants to implement new lifestyles; that analyzed from the perspective of positivism has generated changes in some sectors that are necessary for the development of the country. Migrating to a virtualized teaching and learning methodology has meant a real challenge for teachers, students, parents and advances for the education sector. This research analyzes the inverted classroom in the teaching-learning process in Natural Sciences, using field, bibliographic and descriptive research, detecting that this method was widely used in higher education; but in primary school education it was very little explored, a survey was applied that was useful to collect relevant information on the advantages, disadvantages and limitations of this teaching method, information that was represented and analyzed in statistical graphics. Connectivity, the main problem evidenced, because a large part of Ecuadorian families do not have access to technological means or internet availability, either due to limited economic resources or because they live in rural areas where there is no coverage, requiring the government to invest more in technology, education and being prepared for any emergent and unforeseen in time.

INTRODUCTION

Technological advances and globalization have generated multiple opportunities for change in the field of education, offering teachers a group of tools, techniques and methods to prepare and impart content in a dynamic, entertaining and fun way, awakening interest and commitment in the student to acquire knowledge. According to (Martínez & Heredia, 2010), the use of

Information and Communication Technologies (ICT) in education is defined as interactive, flexible, entertaining with the ability to transfer wide and instantaneous information.

The true integration of ICT in education occurs when the educational system provides meaningful learning, the product of experiential experiences and reflective content, capable of generating significant knowledge in the student and teacher, in each space and moment in which it is observed an apprenticeship; In addition to the classroom, it is an achievement of significance (Hernández R., 2017).

The flipped classroom is a study modality that consists of the student becoming the protagonist and constructor of their own knowledge, modifying the traditional training standards; based on the strategy of offering students, prior to classes, study material so that they become familiar with it from their homes, later, in the classroom, deepen the themes and practical development of activities, transforming the teacher in a support and guidance for their students; system that, despite having been present in the educational sector as part of numerous universities in the world, was little experienced in education centers for children and young people before the Covid-19 pandemic (Gaviria, Arango, Valencia and Bran, 2019).

The presence of Covid-19, resulted in governments pronouncing themselves in favor of adopting and implementing health emergency measures, confinement and social isolation to prevent the spread of the virus, seeing the need to use new systems, methods and techniques of teaching, becoming the Inverted Classroom as one of the best learning schemes for contingency; also, a good alternative for the later stages (Sánchez, 2020).

Studies carried out by several researchers have shown that the action of introducing active learning activities in school classes generates important improvements in the academic performance of students. In various disciplinary teaching and science contexts. This method mitigates the loss of time, due to the fact of transmitting the content to be learned through online channels, creating ideal conditions to implement more active learning within the classrooms with a collaborative learning environment (Prieto, et al., 2020).

This teaching methodology has been applied in subjects such as mathematics, health sciences, law, among others. These have been developed primarily in the US, China, Spain and in Latin America in Ecuador, Mexico and Colombia. An investigation carried out comparing the flipped classroom methodology and the traditional one showed that, in both the math and Spanish classes, the flipped classroom classes had better grades.

Introducing the tools on topics related to natural sciences in children at an early age or school stage in an entertaining, dynamic way, is necessary to achieve arousal interest in natural sciences and other basic sciences, which are the basis for the training of professional scientists of the tomorrow, because the future of all nations depends on what science professionals are capable of doing (Arteaga, Armada, & Del Sol, 2016).

In this research, appropriate methods and techniques were applied to obtain real and reliable data regarding the use of the flipped classroom in times of the Covid-2019 pandemic, the analytical-descriptive method was used to analyze effects, advantages, disadvantages and limitations of this methodology, thus Likewise, a survey of teachers from Basic Education centers in the area was used to measure the level of impact of this methodology on the teaching and learning process of students, making use of the statistical graphic representation.

The population consisted of 20 teachers who teach the subject of natural sciences in basic education centers, to whom a survey was applied to know how the process of adaptation of this methodology has been, its contribution and complexities in the teaching process and children's learning in natural sciences.

MATERIALS AND METHODS

To develop this work, a mixed type of research was applied, using the bibliographic search to collect information inherent to the flipped classroom and the teaching and learning process in times of pandemic, in addition to a field study that allowed the collection of primary data (Pacheco & Blanco, 2015). Together, the analytical method was used to determine the limitations such as the benefits of the inverted classroom in the teaching-learning process of the matter of natural sciences (Rodríguez & Pérez, 2017), they teach that the analysis is a logical procedure that makes it possible to mentally decompose everything in its parts and qualities.

Transactional analysis was used to analyze the behavior of human relationships that students, parents and teachers have, in the face of the pandemic and the study methodology applied by the leaders of the education system (Durán, Buenrostro, & García, 2017), argued that transactional analysis is a theory of personality and human relationships.

The statistical method was used to perform the percentage analysis, in order to obtain quantitative data on the use of the flipped classroom in the teaching and learning process of children in natural sciences, according to (Rico, Esquivel, & Vera, 2015) the Statistical method is a mathematical way of obtaining results, at the same time finding a conclusion to the data provided. The application of a questionnaire was essential to identify the limitations and benefits obtained from the use of the flipped classroom in the teaching-learning process of the natural science contents taught in children of 7th grade, this was carried out virtually through of a closed question survey.

ANALYSIS AND DISCUSSION OF THE RESULTS

The difficult and complex epidemiological situation "Covid-19" that the whole world is experiencing has highlighted the enormous commitments of all systems, mainly in the educational system, initially presenting a scenario of uncertainty in the entire educational community, forcing governments to take immediate measures to develop and implement timely pedagogical strategies

that mitigate the impact of the pandemic in the education sector. The Guide prepared by the (State Education Team for Full Inclusion with contributions from the Family Commission, 2020) quotes UNESCO, who states that; Around the world there are 188 countries affected by the closure of schools, which involves more than 1.57 billion students worldwide (92% of the global student population).

Social distancing is part of the biosecurity measures implemented by the World Health Organization (WHO), to minimize the risk of contagion and the spread of the virus itself, a restriction that has impacted education at all levels, extending while spread the level of contagion, students and teachers will not be able to meet physically in educational facilities "schools and universities", being necessary to apply the virtual study modality, characterized in that the student becomes the main protagonist of their own learning and the teacher in the guide, a method known as inverted classroom (Vidal, Rivera, Nolla, Morales, & Vialart, 2016).

It is necessary to promote this practice in the field of school education in order to increase its effectiveness to promote research that responds quickly and effectively to the social challenges in which students are immersed (Cobeña & Rodríguez, 2019), being necessary that students have the accompaniment of teachers, who may have a greater pedagogical praxis with the inverted classroom in order to use it effectively, MosqueraCucalón (2014), complements this by pointing out that: For the implementation of this method, a triad will be necessary in which the student, the teacher and the parent are involved, each of the actors plays an important role in the process ”.

In the reality of times of physical distancing, this type of study has allowed to continue with the usual classes without this sanitary measure being a limiting factor in the teaching-learning process, becoming the means for both the teacher and the students to continue in the classroom. training process with the help of virtuality, connectivity and technological resources, allowing to strengthen communication (Montealegre, 2020).

Technology will not replace the teacher, especially now, from basic to higher education, it is a long journey, it is inconceivable to consider that technology, perform the work or the role of educator, it not only involves the use of devices, but rather a set of factors so that these technological devices can function efficiently, as in the case of a platform to impart content (Guerrero & Kalman, 2010; Najman et al., 2020). In all kinds of formal education, a person is needed to provide feedback on the student's performance, contribute his or her expertise and report on the management of the content for training and at the same time play the role of guide among the proposed contents, which motivates the students. students and identify their strengths and weaknesses so that they have the opportunity to investigate, specialize their knowledge and build their profile.

The learning that is achieved in a particular subject depends on the previous knowledge that the child has in his memory and on how motivated he is to store new information, because an unmotivated child will not be ready to place all his attention to process, analyze and retain what is indicated or explained

by the teacher, for this reason it is necessary for teachers to be trained in pedagogy that they train in the use of new teaching methods and techniques.

This pedagogical model is characterized by inverting the two crucial moments in traditional education: the first, which concerns the activities of the classes, such as the presentation of the contents by the teacher, and the second, to the execution of curricular activities outside the classroom. school, like homework. This is how, in the flipped classroom, the tasks or projects are specified in the classroom and the thematic contents are learned outside of school (Merla & Yáñez, 2015; Nyandra et al., 2018). Figure 1 shows the flow of information between the teacher and the students in the flipped classroom where the teacher initiates the link with a diagnosis of difficulties and problems in the students.

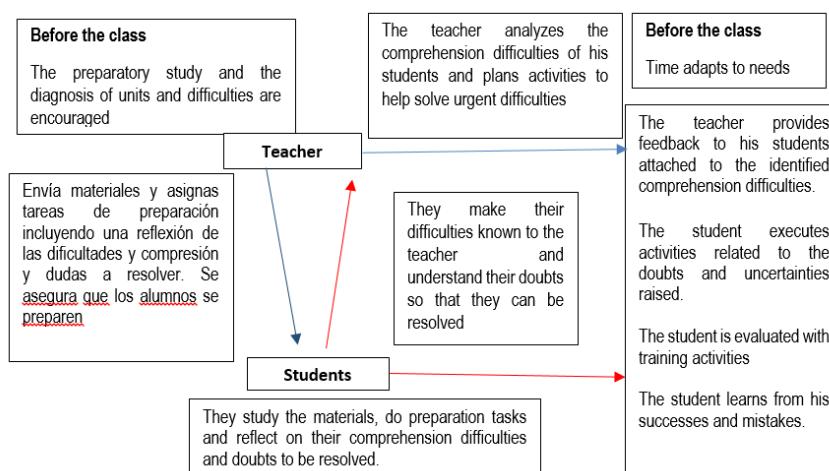


Figure 1 Information flows between the teacher and the students in the flipped classroom

Source: (Prieto, et al., 2020)

Any teaching proposal supported by the use of ICT requires foundations in the pedagogical principles aimed at implementing and promoting comprehensive training for students, making it much more dynamic and interactive for listeners. In this context, an appropriate selection of teaching strategies becomes relevant to successfully develop the flipped classroom model in virtual environments, highlighting (García, 2013), that in this type of teaching “the students are given a voice and left to be the main actor in the class, which is gradually configured according to the same development that they require and propose ”(p. 5).

There are factors that have caused controversy regarding the learning results achieved in the student, there are multiple difficulties and dissatisfaction on the part of teachers and students, which are shown in Figure 2.

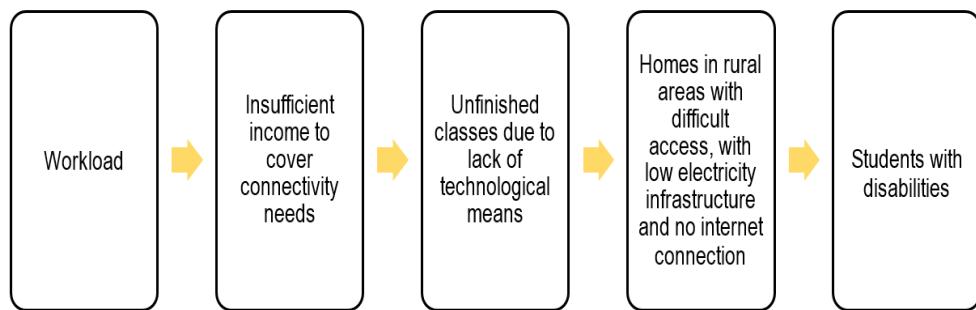


Figure 2 Difficulties and dissatisfaction with the classroom method inverted
Source: (Beteille, 2020)

Figure 3 reflects the results of a study carried out by the National Institute of Statistics and Geography (INEGI) (INEGI, 2020), in Ecuador in which it was evidenced that only 44.3% of the households have a computer, 56.4% have an Internet connection and 10.7% access the Internet outside their home, shown in figure 3.

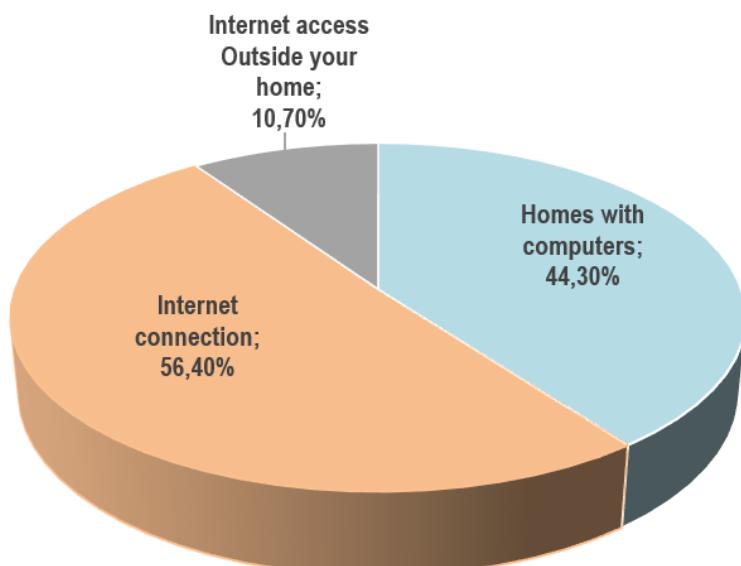


Figure 3 Connectivity of Ecuadorian families
Source: (INEGI, 2020)

The inverted classroom strategy does not It is the solution, but if it is one of the alternatives for educational institutions to achieve a transformation (Montealegre, 2020; Solórzano et al., 2020), as is the case with social generations, contradicting what is indicated. Adopted by (Hernández & Tecpan, 2017; Sidiartha et al., 2020), who state that the flipped classroom as an educational model seeks to enhance learning through a greater diversity of activities, which does not imply a greater amount of work for the student.

There are certain drawbacks of the flipped classroom model as indicated (Obdulia& Huerta, 2019), specifying what; For this methodology to be successful, the learner's interaction is greatly needed, developing their learning tasks autonomously at home. Likewise, the teacher must have an adequate integration of practical skills and work at home; planning and selecting the

contents available to students. Finally, the use of technology in which the materials are sent that must be available to students.

The factors that influence the success of this methodology are related to quality online material, organized face-to-face classes, where the teacher identifies the difficulties that the students' previous learning copes with and uses the appropriate resources to correct the errors of understanding that They can be produced, guide the learning of a group that may or may not be very numerous, to the appropriation and mobilization of their personal and professional skills, also promoting student-teacher interaction, seeking personalized attention. The study methodology has its advantages and disadvantages compared to the teaching and learning process, observed in table 1.

Table 1 Advantages and disadvantages of the flipped classroom

Advantages	Disadvantages
Having time to review and discuss the topics and tasks that are more complex, either individually or by group It	generates a digital divide, since not all students have access to ICT to access content and classes.
The classroom becomes an interactive and active workplace	Seeks results, but does not focus on the methodology
Contributes to developing the learner's creativity and critical thinking	There is little control of the teacher in the development of the student's activities at home
The student has at your disposal the material with the topics to learn, the same that you can access when you see fit	More work for the teacher
Eliminate traditional jobs such as homework	Increase in time in front of a screen which can trigger consequences with learning through the same style of student and health
Teachers have the facility to share content and information with the community of parents, students and teachers	Research is limited, that is, inquiry learning because the material is provided and chosen by the teacher.
Homework delivery and review becomes much easier	Little parental involvement in the development of the child's activities
Learning is centered on the student and their collaboration in small groups	Project-based learning is almost nil
The student is motivated and more involved It	forces the teacher to become familiar with ICTs, which may take time while he is adapting
The student is responsible for his own learning	Little student self-discipline

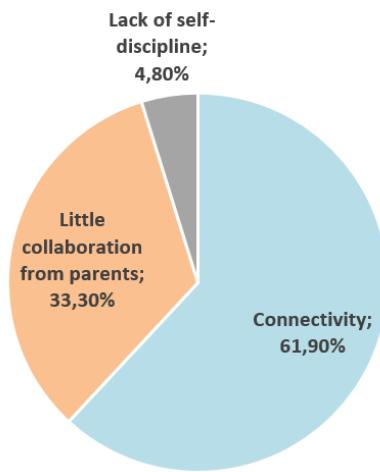
Source: Own elaboration from (Ramos, 2019).

Of the 20 teachers surveyed, 57.10% have used the flipped classroom before the pandemic by sharing content online with their students, according to (Prieto, et al., 2020; Velázquez et al., 2020), the teacher who takes the initiative to invest their classes initiates a process of improvement and of methodological evolution, which is accelerated by the new learning environment, the flipped classroom causes an improvement in communication with students, providing more *feedback* to the teacher, useful to advance innovation in classes.

Of the teachers who have already used this methodology, 55.60% did it to apply collaborative learning among their students, 22.20% to motivate and encourage their children to learn the issues raised within the planning.

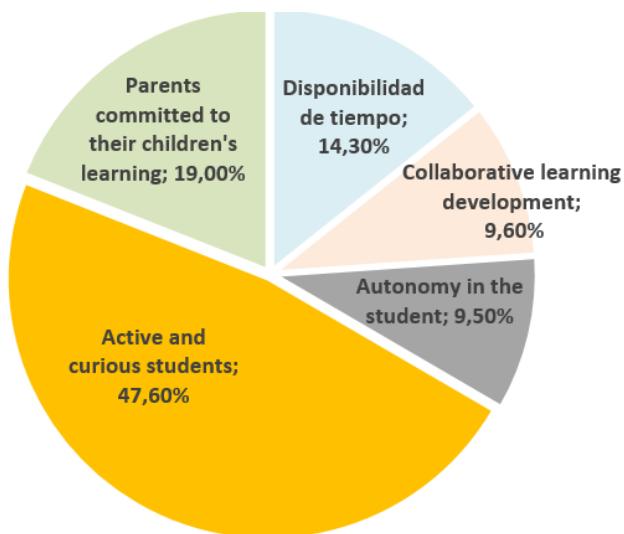
The obligation to change the traditional education scheme for a virtualized and online one, product of the Covid-19 pandemic, 46.40% say they have a good experience with the flipped classroom, followed by 37.30% who say it is very good and only one 16.40% qualify it as bad, likewise most of these teachers 85% think that this methodology awakens the interest and motivation of the child to learn, coinciding with what is indicated by (Ramos, 2019), who states that the flipped classroom is a An effective way to increase student participation, offering very good results in the teaching of Primary Education.

The relevance of the flipped classroom is reflected in the incentive of learning based on the participatory dynamics of the students, presenting a positive effect in the academic spaces (Gaviría, Arango, Valencia, & Bran, 2019; Widana et al., 2020). The methodology is a strategy that improves the level of learning in students and with it, their academic performance. Carrying out individual work from home promotes the student's autonomy in the development of master classes, doing collaborative work benefits the development of skills in organization, planning and exchanging opinions that will help them make decisions and achieve common goals. The results of Figure 5 reflect that one of the main problems detected by the teachers surveyed in relation to the flipped classroom methodology is connectivity with 61.90%, because not all Ecuadorian families have access to a technological medium and they do. They do not have internet, 33.3% were able to indicate the little collaboration of parents since, being children at an early age, they require supervision and help from their parents, results observed in Figure 4.

**Figure 4** Difficulties detected by the teacher

Source: Teachers of the San Martin School

Through the use of the inverted classroom, students are given autonomy to carry out activities that demand less intensity (Gaviría, Arango, Valencia, & Bran, 2019), in this research, 47.60% of those surveyed agree that the main advantage of this methodology where children become more active and participatory in classes, while 19% indicated that there is a more noticeable commitment on the part of parents, the results are shown in figure 5. Results that do not coincide with what was stated by (Prieto, et al., 2020), they in their study showed that the main advantage of the inverted classroom for teachers was the proportion of extra time, which allows more motivated and with greater preparation to carry out activities in which they have to reason and apply what they have learned.

**Figure 5** Advantages detected by the teacher

Source: Teachers of the San Martin School

The flipped classroom, in addition to motivating students to prepare for classes, gives them autonomy and capacity to carry out activities individually or in small collaborative groups, work that is facilitated by the teacher, with the proper indications for the preparation of the tasks they have to carry out

and the formative assessment questions they must answer, as well as their interaction with the instructional materials, achieving positive results.

The academic performance of the students against this methodology was rated as good by 52.40% of the respondents, coinciding with (Mingorance, Trujillo, Cáceres, & Torres, 2017), who in their study on the improvement of academic performance with the methodology flipped classroom showed significant differences in grades compared to those who developed traditional learning. When making the comparison of the mean in grades, they observed that it was higher in the group with an inverted approach, but with respect to the connectivity of the students, only 66% were connected according to the respondents, results contrary to what was stated by (Mingorance, Trujillo, Cáceres, & Torres, 2017), who maintain that the methodology improves the attendance of students.

Global internet coverage is not balanced, the existence of the digital divide is apparent at first glance between countries called the North and those of the South, verifying itself as a reality and that it has intensified in the face of the pandemic situation Covid-19. In Ecuador this reality is clear where hundreds of students of different levels have been forced to withdraw from virtual classrooms for not having technological tools. The (United Nations Children's Fund, 2020) indicates that school-age children with the greatest probability of being left behind due to the closure of schools as a result of social distancing, are those who belong to the poorest households and reside in rural zones.

It is estimated that in the world there are around 72% of school-age children who do not have access to virtual education as a result of living in the poorest households in their countries. But there is another group of children who, despite having the necessary technology and tools at home, cannot study through the platforms due to the incidence of other factors that prevent them, in figure 6 the reasons are shown. That there are children without studying.

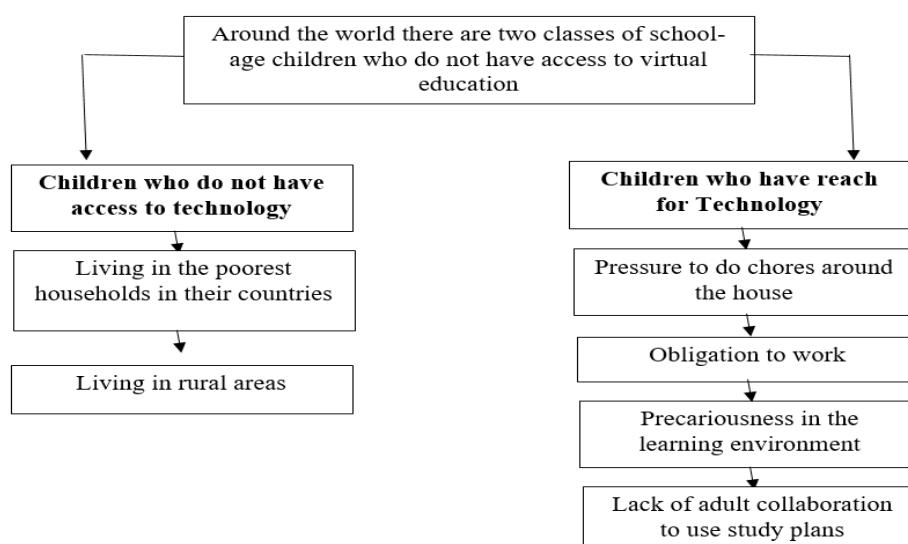


Figure 6 Reasons why there are children without studying in the face of the pandemic

Source: (United Nations Children's Fund, 2020)

From the point of view of continuity and positivism, when adapting new teaching and learning strategies, where the teacher has had to leave his comfort zone, finding himself in the need to acquire training and knowledge in pedagogy as well as in technology, changing paradigms of transmitting concepts and content within a classroom, has allowed to respond to this new generation of children who, by being surrounded by technological means require new forms of learning, thus preparing competent young people for the future, who are the great researchers that respond to the multiple problems of society (Cobeña & Rodríguez, 2019).

Bearing in mind that education is the means by which human beings expand their knowledge and skills, allowing them to access better jobs in the future and thereby improve the quality of life, a quality education must be provided with methods and updated techniques that generate change with the main objective of training future competent professionals, capable of finding quick and efficient solutions to problems that arise in the workplace and daily life. Although connectivity is the main problem detected among the teachers surveyed, the academic performance of the students is good, which implies that, if there is the dedication and desire to learn of the students in the face of adversity, although not everyone can access a computer or some technological means when needed.

CONCLUSIONS

The virtual classroom is a methodology that has allowed the educational process to continue complying with the academic schedule during the time of the pandemic, energizing the virtual classes, not stopping the teaching process, managing to exchange the topics to be discussed in different ways, so that The student reviews, reads and analyzes the material, reflecting on what was in his capacity to understand, and including the transmission of doubts and concerns to the teacher so that they can be resolved immediately and reinforced with extra activities that the student has to develop.

There is a high deficit in the distribution and coverage of internet service, an increase in the incidence of poverty. The field of education, like many other sectors, was not technologically prepared with tools and platforms that would allow the classes to start without difficulty in the beginning, being evidence that the Ecuadorian government needs to allocate part of the education budget to implement technology in the centers of school education to provide rapid responses to emerging situations such as the Covid-19 pandemic.

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