

## Peruvian National Strategy for Educational Reinsertion and Continuity: An Analysis of Post-Pandemic School Dropout Reduction

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### Abstract

*School dropout is a problem that affects many countries, especially during the pandemic. Access to basic services, protective resources (masks, face shields and hand washing) and vaccination coverage for teachers and students are essential elements to ensure educational continuity. The objective of this research was to analyze the impact of the national strategy for educational reinsertion and continuity established by the Peruvian government to guarantee continuity in regular basic education for Peruvian students at risk of dropping out of school in the period 2021-2022. The following indicators were analyzed: number of students enrolled in RBE, teachers, educational services and vaccination coverage, corresponding to the 25 regions of Peru in the period 2021 - 2022. The results showed that access to basic services and teacher vaccination coverage were the most influential resources for continuity in 2021, with internet access as another key resource for continuity in 2022.*

**Keywords:** *school dropout; continuity of education; regular basic education; access to resources.*

### 1. Introduction

School dropout is a global problem that has increased as a result of the pandemic. According to the Economic Commission for Latin America and the Caribbean (ECLAC), the region is facing the dual challenge of school dropout and student retention in regular basic education, given the low probability that a student will return once they leave the education system [1]. During the first year of the pandemic, the World Bank estimated that in Latin America and the Caribbean, the dropout rate would increase by 15% among students aged 6 to 17 years, which implies a restriction in education service coverage and non-compliance with the target of the fourth Sustainable Development Goal (SDG): "Ensure, by 2030, that all girls and boys complete primary and secondary education, which should be free, equitable, of high quality and produce relevant and effective learning outcomes" [2].

The United Nations Educational, Scientific and Cultural Organisation (UNESCO) defines dropout as "the situation in which students leave education before completing a given level of education, without having obtained an equivalent qualification or certificate" [3]. Dropout is thus a milestone of abandonment of the education system and represents the

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culmination of a progressive process of distancing between the student and the education system [4]. In addition, the interruption of face-to-face classes, the transition to virtual education and the limitations imposed by health measures to prevent the pandemic have contributed to the increase in dropout [5]. An estimated 24 million students, from pre-primary to university level, are at risk of not returning to school after the pandemic interruption of education. At the primary and secondary school levels, 10.9 million students are at risk of dropping out, in addition to the 258 million children and youth who were out of school before the pandemic [6].

In the European Union, since 2014, a national strategy was established to prevent early school leaving, aiming at a rate of less than 10% and identifying groups at risk of dropping out of school. As a result of this strategy, by 2020, an average early school leaving rate of 9.9% was detected in all Member States; however, Spain, Romania, Italy, Bulgaria and Malta had the highest dropout rates [7,8,9].

In some Latin American countries (LATAM), such as Mexico, it was determined that 740,000 school-age students failed to complete the academic year in which they were enrolled, and of these, only 3% indicated that it was due to causes unrelated to the pandemic [10]. Also, in Ecuador, more than 900,000 students dropped out of school, so the teaching and learning process has been hampered, not only by health conditions but also by the lack of economic and technological resources, which limit the virtual education of online teaching days; despite the willingness of teachers, a significant number of students continued to be absent because, although they wanted to attend, they lacked the necessary resources [11, 12].

The traditional educational model underwent mandatory changes aimed at adopting digital tools and skills [12, 13, 14, 15]. As a preventive health measure against the spread of COVID-19, schools were closed worldwide. In turn, each country established contingency measures to compensate for the effects of the pandemic in the education sector. An Education Contingency Plan was implemented in nine countries, including Bolivia, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama and Paraguay, to ensure continuity of learning during the pandemic.

Prior to the crisis, most of these countries already faced challenges in water, sanitation and hygiene (toiled) services in schools. In 2019, an estimated 61 million school-aged children and adolescents had limited or no access to handwashing facilities while at school. Sixteen % of educational institutions lacked water facilities, 12% had no handwashing facilities, while 28% had limited handwashing facilities (i.e. handwashing facilities with water but no soap). In Ecuador, an assessment found that 26 % of public schools lacked adequate water facilities, 28% lacked acceptable hygiene facilities and 20 % lacked adequate sanitation facilities [16]. In Mexico, during the 2020-2021 school year, about 61.7 % of primary schools and 65.5 % of secondary schools had all basic services, but the availability of information technologies was low [17].

In conjunction with health security measures, LATAM countries have devised strategies, programmes and procedures to address the educational challenges exacerbated by the pandemic. An illustrative case is that of Ecuador's Ministry of Education, in 2020, which highlighted the importance of educational support networks that bring together various local actors to support educational continuity. On the other hand, Guatemala, in its 'Pilot application of safe return to semi-presential classes for primary and secondary schools', planned the implementation of a reinforcement and levelling programme based on a prior comprehensive diagnosis, including the evaluation of emotional skills and conceptual, attitudinal and procedural achievements. Meanwhile, Chile, in 2021, developed the programme 'Chile Recupera y Aprende' (Chilean Ministry of Education), focused on the recovery and levelling of learning, socio-emotional well-being, and the retention and reincorporation of students who, due to the health crisis, have dropped out or are at risk of dropping out of the education system. It is important to note that, until March 2021, the

back-to-school process was carried out in a progressive and flexible manner. Approximately 67% of LATAM countries - Andorra, Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Spain, Guatemala, Paraguay, Portugal and Uruguay - have opted to return to classes in person [18].

In the Peruvian context, the Education Statistics Unit of the Ministry of Education (MINEDU) defines dropout as "the number of students enrolled in a given level (pre-school, primary or secondary) of Regular Basic Education (EBR) who did not re-enrol in EBR in the following year, excluding those who died or passed the last grade of secondary school" [19].

MINEDU proposed a National Strategy for Reinsertion and Educational Continuity to address the challenge of facilitating the return to school of more than 124,000 RBE students who had their studies interrupted between 2020 and 2021, as well as guaranteeing the continuity of the 347,368 students who were enrolled and at risk of dropping out of school in 2022 [20]. In relation to this, it is important to consider that educational continuity focuses on enabling students to continue learning and progress along their educational pathway without experiencing significant interruptions [21]. This implies guaranteeing the necessary conditions and resources to maintain a smooth teaching and learning process, even in situations of change, such as emergencies, crises or disruptive events.

Ministerial Resolution No. 531-2021-MINEDU approved the normative document entitled "Provisions for the return to face-to-face and/or blended learning, as well as for the provision of educational services for the 2022 school year in educational institutions and programmes of Basic Education, located in urban and rural areas, within the framework of the health emergency due to COVID-19". The Peruvian government implemented various measures to ensure educational continuity, including access to basic services, provision of protective resources and vaccination coverage against COVID-19. By prioritising these resources, it sought to protect the health and well-being of students and teachers, to minimise disruptions to the educational process and to promote an environment conducive to learning [22].

School dropout in Peru during the pandemic has been influenced by various causes. The main one is the digital divide, manifested in the lack of resources, both in terms of devices (computer or laptop) and indispensable services (internet connection) for virtual education. In addition, another evident cause lies in the teaching-learning methodologies adapted to the virtual environment, due to the lack of pedagogical and technological competences of most teachers, making appropriate interaction between teacher and student difficult. The economic impact has also played a crucial role, reflected in the prioritisation of basic expenses such as health and food, relegating educational expenses to the background and even temporarily discarding them [12,14].

If this problem continues, it will have a significant impact on both the student and the Peruvian government. In terms of human development, dropping out of school can perpetuate inequality and social exclusion. Students who drop out of regular basic education often have fewer opportunities to access quality jobs and improve their living conditions, which can lead to a persistent gap between socio-economic groups. At the government level, educational dropout has a number of negative economic consequences: decreased productivity, perpetuation of poverty, increased likelihood of dependence on social assistance programmes, and the impact on tax revenues and public investment. Addressing this issue is therefore essential to promote sustainable and equitable economic growth [23].

Considering this problem, the following research question was posed: What is the impact of the National Strategy for Educational Reinsertion and Continuity established by the Peruvian government on the continuity of regular basic education during the post-pandemic period? and as specific questions: RQ1: How are the resources destined to

guarantee the continuity of regular basic education during the post-pandemic period characterised? RQ2: Is there a significant difference in the continuity of regular basic education in 2021 and 2022? RQ3: What resources influence the continuity of regular basic education in 2021 and 2022? RQ4: Is there similarity between regions in terms of resources influencing the continuity of regular basic education in the post-pandemic period?

This research is justified by its social implications in understanding how the implementation of the strategy of educational reinsertion and continuity can directly benefit Peruvian students in Regular Basic Education (EBR) who have faced interruptions due to the pandemic. By analysing the barriers that students face when returning to the classroom, it seeks to promote an inclusive educational environment conducive to their overall well-being. Furthermore, it is justified by its economic implication, as by investing in education through this strategy, students were provided with the opportunity to acquire skills and knowledge necessary to face future challenges, thus contributing to the formation of a skilled workforce that is attractive for investment and capable of driving innovation and productivity in the country. Reducing school dropout rates can not only reduce socio-economic disparities, but also strengthen social cohesion and economic stability [24].

The objective of this research was to determine the impact of the National Strategy for Educational Reinsertion and Continuity established by the Peruvian government on the continuity of regular basic education during the post-pandemic period, and specifically: O1: To describe the resources allocated to guarantee the continuity of regular basic education during the post-pandemic period. O2: Determine the significant difference in the continuity of regular basic education in 2021 and 2022. O3: Identify the resources influencing the continuity of regular basic education in 2021 and 2022. O4: Determine the similarity between regions in terms of resources influencing the continuity of regular basic education in the post-pandemic period.

Due to the positive effects generated by the strategies implemented by the governments of LATAM countries in the post-pandemic period, the following research hypothesis was proposed: the National Strategy for Educational Reinsertion and Continuity established by the Peruvian government had a significant and positive impact on the continuity of regular basic education during the post-pandemic period.

## 2. Theoretical framework

### 2.1 Antecedents

In Latin America and the Caribbean, there have been a number of studies that focus on the impact of government policies in the education sector after the pandemic period. Among these, one study stands out, which aimed to examine the predominant effects of the pandemic on the education sector. In analysing the contexts, it became clear that the education sector was already grappling with a number of long-standing challenges and persistent obstacles. However, the arrival of the pandemic introduced an unprecedented pedagogical challenge: how to mitigate the negative impact of the closure of schools and educational institutions. Faced with this situation, a pressing need emerged to quickly adopt new technologies, digital platforms and online education programmes to preserve the continuity of educational goals. However, the abrupt transition from the traditional to the virtual educational environment exacerbated existing disparities and accentuated already existing difficulties, posing additional challenges. In conclusion, it highlights the urgent need for governments to allocate adequate resources to ensure that education is available to all, regardless of socio-economic status, and that it maintains high standards of quality [25].

Chile is among those countries whose students experienced prolonged absence from school due to the pandemic. A study revealed that the dropout rate reached 50,529 students, an increase of 24 % over the previous year. Based on estimates by educational institutions, during the second half of 2021, approximately 25 % of students lacked adequate access to connectivity. According to the Pandemic School Monitoring Survey 2021, public schools were the most affected by the lack of connectivity, reaching 33%. In response to this problem, the Ministry of Education established the reactivation of the education system as a primary objective for the year 2023. To achieve this, the "Seamos Comunidad" (Let's Be a Community) policy was launched to address the impacts of the pandemic on educational communities and their members. This policy focuses on critical aspects such as school coexistence, mental health, comprehensive recovery of learning processes, improved infrastructure, connectivity and digital transformation, as well as student retention in the education system. In addition, an early warning system was implemented to target interventions to address connectivity issues in education, supplementary academic supports such as tutoring, as well as the implementation of the Multi-Level System of Support to address mental health challenges [26]

In Mexico, research found that 5.2 million children, adolescents and young people of school age did not enrol for the 2020-2021 school year for economic reasons and because of COVID-19. Also, only 20% of public school students owned a computer or tablet at home, while in private institutions this proportion exceeded 50%. For this reason, the "National Strategy" was launched to recover lost learning and reduce dropout rates in basic education establishments, complemented in parallel with the programme "Vamos todas y todos por la educación", which seeks to reincorporate those students who interrupted their educational process through incentives, such as scholarships, uniforms and food, educational support (tutoring) and the strengthening of socio-emotional skills. For the 2023-2024 school year, the new educational model is expected to promote inclusive and quality education, with the participation of various actors such as the government, education authorities, teachers, parents and civil society [27].

In Venezuela, research was undertaken to identify the predominant factors that prompted a considerable number of students to drop out of school during the period of the COVID-19 pandemic. Through this analysis, it was concluded that several elements contributed to school dropout, the most prominent being: economic reasons affecting affordability, complex family dynamics, socio-cultural influences, limitations in the ability to use digital tools, and health-related concerns. These findings highlight the interconnectedness of diverse factors in the current educational landscape and underscore the need to implement comprehensive strategies that address these multiple facets to mitigate the dropout phenomenon in the country [28].

In Ecuador, the need arose to evaluate the factors that have driven school dropout in the "Amazonas" Educational Unit and in the Educational District, with the purpose of developing a proposal applicable both in the post-pandemic period and in future emergency situations, allowing students to maintain their education. This evaluation considers academic, socio-economic and family aspects, adapted to the territorial context of the research. The results revealed a direct correlation between the factors, with the socio-economic factor standing out, followed by the family factor and, finally, the academic factor. Based on these findings, a pedagogical proposal was formulated to improve the commitment and motivation of students in their autonomous and directed learning, thus addressing school dropout in a comprehensive and sustainable manner in the country [29].

Years ago, in the town of Manta, Ecuador, a study was carried out to analyse the problem of school dropout in order to create innovative measures to encourage the continuation of education, a fundamental right. The results revealed that student dropout was predominantly due to economic difficulties and lack of access to connectivity. In this context, it was identified that the support provided by teachers in the form of pedagogical

cards had a crucial impact on counteracting this problem, contributing to reducing dropout in Manta's schools [30]

In Colombia, the influence of determinants related to school dropout during the pandemic was investigated. Among the results of the study, a common pattern was identified: lack of economic resources emerges as the main reason behind school dropout. This is because, in rural communities, lack of financial resources prevents families from accessing the necessary technology, and thus virtual classes. As a result, many families were forced to make the difficult decision to withdraw their children from education, which in turn contributed to an increase in child labour [31].

Other research conducted in Colombia aimed to analyse the education system in the post-pandemic period, exposing major problems in the education system. The findings indicated an increase in school dropout rates between November 2022 and May 2023. Over this interval, approximately 473,786 young people dropped out of the education system, a significant increase compared to previous years. In addition, a wide technological disparity between the private and public education sector was revealed. At this juncture, the government is expected to recognise the transformative impact of education in changing the world. This awareness should drive the transformation of the social environment and the overcoming of present obstacles. The pandemic has provided clear lessons for governments on the need to engage with political determination, committing the necessary resources and efforts to reduce social inequality and ensure quality public education for all [32]

In northern Peru, research was conducted to identify the perceptions of students, teachers and parents regarding the main causes, interventions and ways of coping with school dropout following the COVID-19 pandemic. The results showed that, from the students' perspective, the main reason for dropping out of school is the need to contribute financially to their households (44.64%, 250 students). As for the teachers, they indicated that lack of parental support (33.33%, 10 teachers) was the main factor contributing to dropout, while 26.66% (8 teachers) considered that their teaching intervention should include motivational and inspirational lessons. On the other hand, for parents, financial problems (45.0%, 90 parents) were the main challenge in dealing with their children's dropout. It is concluded that, financial issues continue to be a significant obstacle to the continuity of education, posing a persistent challenge in the current educational landscape [33].

## 2.2 Theories related to the research

### 2.2.1 Human capital theory

Human capital theory, pioneered by influential economist Gary Becker, argues that education and training represent investments with the capacity to expand individual productivity and skills, thus having a significant impact on a community's economic development and social progress. This perspective becomes even more relevant in times of crisis, such as the pandemic, as it highlights the need to channel resources into the development and training of educators, seen as a critical resource for ensuring educational continuity in adverse situations. This investment not only has an impact on educators by improving their performance and confidence, but also has a strengthening effect on the education system as a whole. By enhancing the capacities of teachers, it fosters greater adaptability and resilience in the system, enabling it to successfully address changing challenges and ensure high quality and sustainable education in any setting [34].

### 2.2.2 Theory of the systemic approach

The theory of the systems approach is essential to safeguard educational continuity in times of crisis and transformation. It conceives education as interconnected in which multiple components, such as educational institutions, teachers, students, curricula and technologies, interact holistically and collaboratively. This theory, pioneered by Ludwig

von Bertalanffy, transcends momentary solutions and addresses challenges in a broader context. The systems approach not only addresses immediate adaptation, such as the migration to online learning, but also explores the ramifications for the entire education ecosystem, from the quality of learning to the equity and well-being of educators and learners. This allows for adapting not only teaching methods, but also policies and teacher training, ensuring a holistic and effective response to the challenges. In short, the systems approach provides a holistic perspective to sustain education in difficult times [35].

### 2.3 National Strategy for Reintegration and Continuity of Education

It is a comprehensive plan implemented by the Peruvian government to address educational challenges that arose as a result of disruptions in education, especially during crisis situations such as the pandemic. This strategy focuses on ensuring that students, particularly those at risk of dropping out of school, can stay connected to the educational process and receive adequate support for their continued learning through intersectoral and intergovernmental actions with territorial relevance [36].

### 2.4 Dropping out of school

Refers to the number of RBE students who voluntarily and prematurely drop out of their academic studies before completing their compulsory studies. This drop-out can occur at any level of education, from primary to secondary education.

### 2.5 Continuity in regular basic education

Percentage of regular basic education students facing high-risk situations that could hinder their educational continuity in the period 2021-2022.

### 2.6 Research variables

#### 2.6.1. Access to basic services

##### 2.6.1.1. Access to drinking water

Refers to the availability of safe and accessible drinking water in educational facilities, with the purpose of ensuring a healthy and adequate environment for the educational development of students. Access to safe drinking water is essential to meet the basic hydration and sanitation needs of students in regular basic education. Ensuring that students have access to safe drinking water during their school day contributes to their overall well-being, concentration and ability to learn. In addition, access to adequate drinking water is essential to promote good hygiene practices and disease prevention, especially in times of health crises.

##### 2.6.1.2. Access to toilets

Refers to the percentage of educational premises that have hygienic services in good condition. Access to these facilities is essential to ensure the health, dignity and well-being of students in regular basic education. Hygienic facilities include toilets and washrooms that meet hygiene standards and are in good working order. These spaces must be accessible, safe, clean and suitable for students' use, taking into account their needs for privacy and comfort.

##### 2.6.1.3. Sewage networks

Comprises the percentage of educational premises that have access to sewage systems for regular basic education students that guarantee educational continuity. refers to the availability and operation of sanitary sewage systems in schools, with the purpose of ensuring adequate sanitation, health and well-being of students, thus promoting educational continuity in a safe and healthy environment.

#### 2.6.1.4. Access to electricity

Refers to the percentage of regular basic education educational premises that have permanent lighting services. The objective of this indicator is to ensure that regular basic education students have access to adequate lighting in their schools, which contributes to creating an environment conducive to learning, improving the quality of teaching and promoting educational continuity.

#### 2.6.1.5. Internet access

Refers to the capacity and ability to connect to the global computer network, enabling the transfer of information and communication between users through various devices. This access implies having a stable and reliable connection to the internet, either through wired connections (such as fibre optic or network cable) or wireless (such as Wi-Fi or mobile connection). In this research it represents the percentage of regular basic education premises that have internet service.

### 2.6.2. Protective resources against Covid-19

#### 2.6.2.1. Distribution of masks

The distribution of face masks for teachers and students in regular basic education, which guarantees educational continuity, is an indicator that refers to the supply and delivery of face masks or mouth masks as part of the prevention and safety measures implemented in the school environment. These masks are distributed with the objective of protecting the health of students and reducing the risk of contagion of diseases, especially during health crises, such as the COVID-19 pandemic.

#### 2.6.2.2. Distribution of face shields

The distribution of face shields for regular basic education teachers and students in regular basic education that ensures educational continuity, also known as face shields or visors, to students and teachers as part of the prevention and safety measures implemented in the school environment. Face shields provide an additional physical barrier that covers the entire face, including the eyes, nose and mouth, and helps prevent the spread of particles and respiratory droplets that can transmit diseases. The distribution of face shields is a key component in maintaining continuity of education, as it complements the use of facemasks and other safety measures.

#### 2.6.2.3. Washbasin

Refers to the number of washbasins per RBE student. These resources are essential elements of personal hygiene maintenance and disease prevention. Their presence in schools gives students the opportunity to wash their hands with soap and water, a simple but effective action to reduce the spread of germs and maintain good health.

### 2.6.3. COVID-19 vaccination coverage

Refers to the percentage of teachers and students vaccinated against COVID-19. This characteristic was obtained from the Ministry of Health (MINSA). This progress involves the administration of vaccines to regular basic education teachers with the aim of reducing the risk of contagion, guaranteeing a safe environment and facilitating a gradual and safe return to classes.

## 3. Materials and methods

The research is quantitative, with a non-experimental design, the scope is descriptive, comparative and correlational. The data collection technique is documentary analysis and a registration form was used as an instrument, compiling information from the 25 regions



of the country during the years 2021 and 2022. The variables and analysis procedures are detailed in the following subsections.

### 3.1 Data collection

Data were obtained from 52 documents containing indicators for the 25 regions of Peru at the national level in the period 2021 - 2022. These indicators were based on the number of students enrolled in RBE, teachers, educational services and vaccination coverage. The information was obtained from the official website "Estadísticas de Calidad Educativa", which belongs to the Ministry of Education. On this website, one should access the option "EduDatos - PERFILES EDUCATIVOS" (<http://escale.minedu.gob.pe/perfil-regional>). The processed dataset can be accessed in the Data Availability Statement section.

Table 1. Distribution of the sample of students by school year.

Year	Regions	Indicators
2021	25	Access to basic services (Access to drinking water and Access to toilets)
		Protective resources against Covid-19 (Washbasin, Distribution of face shields)
		COVID-19 vaccination coverage (teachers and students)
2022	25	Access to basic services (Access to drinking water, electricity, Sewerage and internet)
		COVID-19 vaccination coverage (teachers and students)

### 3.2. Statistical Analysis Method

Descriptive analysis (mean, standard deviation, minimum and maximum) was used to characterize the overall scope of basic services, protective resources and vaccination coverage. For the inferential part, the nonparametric Wilcoxon Ranks test was used to determine if there is a significant difference in the continuity of the RBE for the 2021-2022 periods; likewise, to evaluate the influence of the resources destined to guarantee the continuity of the RBE, multiple linear regression analysis was used with its corresponding test of basic statistical assumptions (normality, homoscedasticity and autocorrelation of the residuals). Finally, to identify the similarity between the regions, according to the resources that influence the continuity of the RBE, multivariate techniques were used, specifically the interdependence method: cluster analysis (dendogram with Euclidean distance). The R software v.4.2.3 with the IDE R Studio v. 2023.06.0 was used for the statistical analysis.

### 3.3. Operationalization of variables

The variables present in the operationalization matrix were proposed by MNEDU, through the regional files corresponding to the post-pandemic period. It is crucial to note that the information presented here comes from various institutions. The school continuity variable was extracted from the Educational Institution Management Support Information System (SIAGIE) in the years 2021 and 2022. For its part, the variable that evaluates access to basic services by educational premises was based on data provided by the Educational Census for the years 2021 and 2022. As for the variable that measures the resources for protection against COVID-19, its origin is found in the Integrated Financial Administration System (SIAF). Finally, the variable that analyzes vaccination coverage against COVID-19 was compiled from information provided by the Ministry of Health (MINSA) during the period between 2021 and 2022.

Table 2. Operationalization matrix of variables

Variable	Indicators	Scale
Educational Continuity	Percentage of educational continuity	
Access to basic services	Access to drinking water	
	Access to toilets	
	Access to sewage networks	
	Access to electricity	
	Access to internet	Reason
Protective resources against COVID-19	Distribution of masks	
	Distribution of face shields	
	Number of washbasins	
Vaccination coverage against COVID-19	Teacher coverage	
	Student coverage	

#### 4. Results

4.1. Regarding the distribution of resources to guarantee the continuity of regular basic education during the period 2021-2022

These results aim to describe the resources allocated to guarantee the continuity of regular basic education in the post-pandemic period, through access to basic services, protective resources and vaccination coverage against COVID-19.

Table 3. Descriptive statistics on the distribution of resources and basic services for regular basic education, 2021.

Statistics	Access to basic services		Protective resources			Vaccination coverage	
	Drinking water	Toilets	Washbasins	Masks	Face shields	Teachers	Students
Mean	0.62	0.563	5.42	7.99	0.59	0.89	0.22
Sd	0.11	0.128	3.58	4.49	0.36	0.06	0.05
Min	0.37	0.339	0.27	0.04	0.003	0.75	0.09
Max	0.84	0.897	14.99	14.52	1.34	0.95	0.3

Sd: Standard deviation, Min: minimum, Max: maximum

In Table 3, with respect to access to basic services, the average proportion of access to drinking water and toilets is 62% and 56.3%, respectively. For protective resources, per student there is an average of 5.42 hand-washing sinks, 7.99 masks and 0.59 face shields. Finally, with respect to vaccination coverage, an average of 89% of teachers and 0.22% of students are vaccinated.

Table 4. Descriptive statistics on the distribution of resources and basic services for regular basic education, 2022.

Statistics	Access to basic services				Vaccination coverage	
	Drinking water	Electricity	Sewage networks	Internet	Teachers	Students
Mean	0.34	0.6	0.4	0.3	0.98	0.77
Sd	0.12	0.14	0.09	0.07	0.01	0.1
Min	0.09	0.17	0.19	0.14	0.96	0.57
Max	0.56	0.84	0.55	0.43	0.99	0.9

Sd: Standard deviation, Min: minimum, Max: maximum

In Table 4, with respect to access to basic services, the average proportion of access to drinking water, electricity, sewage and internet is 34%, 60%, 40% and 30%, respectively. In terms of vaccination coverage, an average of 98% of teachers and 77% of students are vaccinated, with the latter showing an increase compared to 2021.

Table 5. Education and economic sector indices, Peru 2021-2022

Period	School assistance	Access to basic services	Access to internet	Public spending per student (S/) <sup>1</sup>
2021	91.1	33.6	57.9	4220.3
2022	88.2	39.3	54.3	-

<sup>1</sup> Detailed information by region is not available for the year 2022, however, at the national level, an increase of 7.9% is reported compared to what was budgeted for 2021.

In the table 5, as a result of the contingency measures derived from Ministerial Resolution No. 531-2021-MINEDU, presents some important indexes of the education and economic sector. From these indicators, it was identified that, for the 2021-2022 education period, Lima remains as one of the most competitive regions in the country, given that it was ranked second in the education sector: access to basic services: 73.1% and 69.3% (2021 and 2022 respectively) and access to internet: 86.5% and 71.2% (2021 and 2022 respectively). On the other hand, the regions of Loreto and Ucayali are in the penultimate and last position in the education sector, respectively, with the lowest rates.

#### 4.2. Comparison of the continuity of regular basic education for the periods 2021-2022

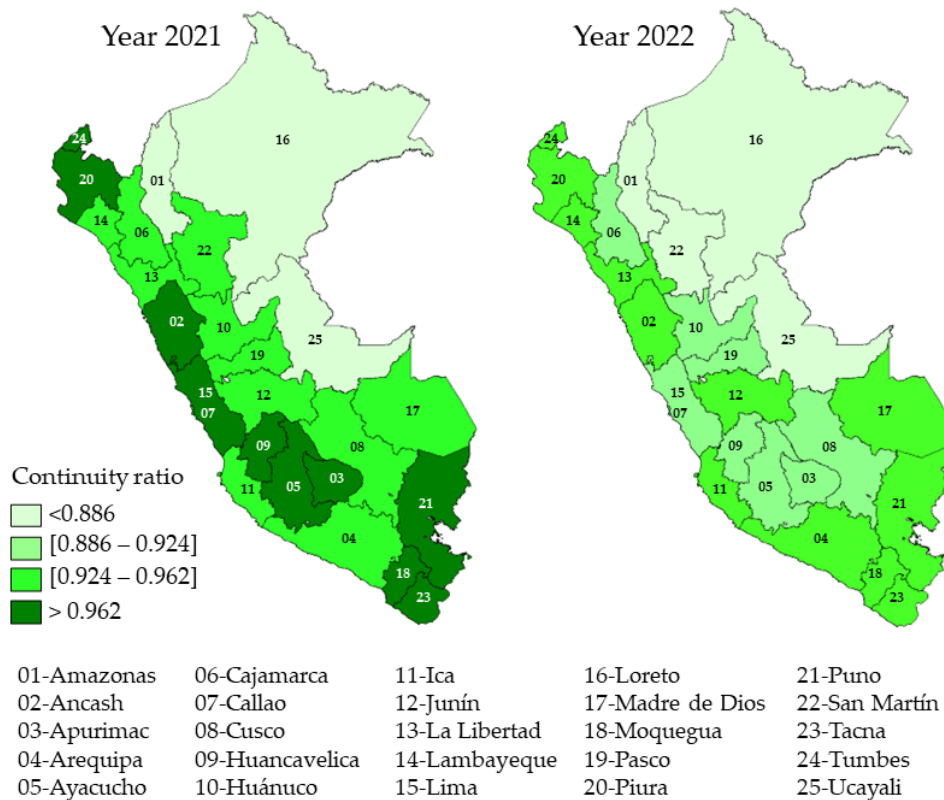


Figure 1. Continuity of regular basic education in the period 2021-2022.

The figure 1 shows that the percentage of educational continuity among students at risk of interrupting their studies is higher in 2021 than in 2022, specifically in the following regions: Tumbes, Piura, Ancash, Lima, Callao, Huancavelica, Ayacucho, Apurimac, Puno, Moquegua and Tacna (Figure 1). In addition, 85,162 and 5,491 RBS students were identified as not yet enrolled and at risk of permanent school dropout in the years 2021 and 2022, respectively.

Table 6. Comparison of continuity ratios for regular basic education, period 2021-2022.

Period	Descriptive statistics				Wilcoxon Test*	
	Mean	Sd	Min	Max	W	p-value
2021	0.95	0.04	0.85	1.00	445.5	0.000
2022	0.91	0.05	0.77	0.96		

\* p-value<0.05 (no normality test per period)

In the Table 6, we observe that in the year 2021, the continuity of regular basic education has a higher proportion of 95%, compared to the year 2022, the year of the return to face-to-face education, where it reached a proportion of educational continuity of 91% This difference is considered highly significant (p<0.01). This difference may be due to the extreme values (min and max) of the variable studied in both periods evaluated.

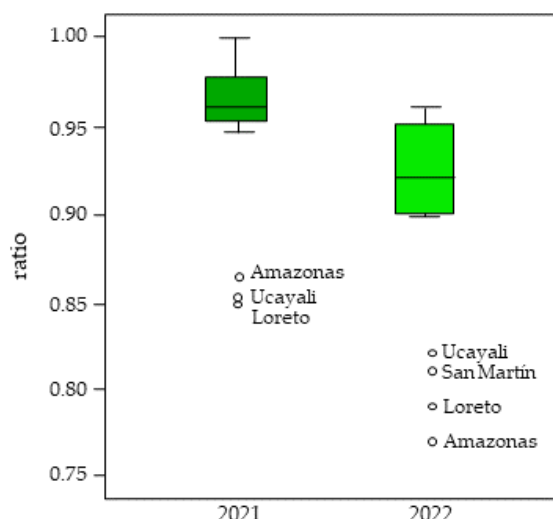


Figure 2. Comparative box-plot of the distributions of educational continuity ratios, period 2021-2022.

The figure 2 shows that the proportion of continuity of RBS students is homogeneous in both periods 2021 and 2022. Likewise, Amazonas, Ucayali and Loreto are the regions with the lowest percentage of educational continuity; and by 2022, San Martín becomes part of the regions (mentioned above) with the lowest percentage of educational continuity.

4.3. Influence of resources destined to guarantee the continuity of regular basic education, period 2021-2022.

Table 7. Analysis of the influence of distributed resources using the multiple linear regression model, period 2021.

Coefficients:	Estimate	t-student	p-value
(Intercept)	0.2927	1.796	0.0893 <sup>a</sup>
Masks (mask)	0.0003	0.242	0.8117
Toilets (tl)	4.4464	2.146	0.0457*
Drinking water (dw)	0.0040	0.068	0.9464
Vaccinated teachers (dv)	0.5921	2.667	0.0157*
vaccinated students (ev)	0.3463	1.531	0.1431
Evaluation of the regression model		Estimate	
R2	0.7317		
R2 adjusted	0.6572		
F-statistic	9.8180		
Estimation error	0.0242		
Durbin-Watson	2.0316		
Breusch-Pagan	9.5741		
Shapiro-Wilk	0.9635		

<sup>a</sup>p-value<0.10, \*p-value: <0.05, \*\*p-value<0.01, \*\*\*p-value<0.001

In the Table 7, the influence of the resources destined to guarantee the continuity of regular basic education during the 2021 period was evaluated, identifying toilets and

vaccinated teachers as influential resources. Eliminating the terms that did not reach statistical significance, the estimated reduced model was obtained:

$$\text{continuity\_ebr\_2021} = 0.2927 + 0.0003 \text{ mask} + 4.4464 \text{ tl} + 0.0040 \text{ dw} + 0.5921 \text{ dv} + 0.3463 \text{ ev} \quad (1)$$

The estimated model represents 73.17% of the continuity of regular basic education for the year 2021. In addition, when evaluating the model assumptions, it was determined that the regression model errors follow a normal distribution (p-value = 0.5126). The Breusch-Pagan test showed that the model errors are homoscedastic (p-value = 0.0882). Finally, the Durbin-Watson test showed that there is no autocorrelation (p-value = 0.984).

Table 8. Analysis of the influence of distributed resources using the multiple linear regression model, period 2022.

Coefficients:	Estimate	t-student	p-value
(Intercept)	-1.9264	-1.889	0.076 <sup>a</sup>
Drinking water (dw)	0.5444	1.956	0.0671 <sup>a</sup>
Electricity (elec)	0.0599	1.019	0.3226
Sewage networks (sn)	-0.6962	-2.065	0.0545 <sup>a</sup>
Internet (inter)	0.3875	2.034	0.0579 <sup>a</sup>
Vaccinated teachers (dv)	2.8095	2.551	0.0207 <sup>*</sup>
vaccinated students (ev)	0.0056	0.058	0.9542
Evaluation of the regression model		Estimate	
R <sup>2</sup>	0.7376		
R <sup>2</sup> adjusted	0.6451		
F-statistic	7.9660		
Estimation error	0.0314		
Durbin-Watson	2.3134		
Breusch-Pagan	4.2131		
Shapiro-Wilk	0.8878		

<sup>a</sup> p-value < 0.10, \*p-value: < 0.05, \*\*p-value < 0.01, \*\*\*p-value < 0.001

In the Table 8, we evaluated the influence of the resources destined to guarantee the continuity of regular basic education during the 2022 period, identifying access to water, sewage network, internet and vaccinated teachers as influential resources. Eliminating the terms that did not reach statistical significance, the estimated reduced model was obtained:

$$\text{continuity\_ebr\_2022} = -1.9264 + 0.5444 \text{ dw} + 0.0599 \text{ elec} - 0.6962 \text{ sn} + 0.3875 \text{ inter} + 2.8095 \text{ dv} + 0.0056 \text{ ev} \quad (2)$$

The estimated model represents 73.76% of the continuity of regular basic education for the year 2022. In addition, when evaluating the model assumptions, it was determined that the regression model errors do not follow a normal distribution (p-value = 0.0120), however, the Breusch-Pagan test showed that the model errors are homo-elastic (p-value = 0.6479). Finally, the Durbin-Watson test showed that there is no autocorrelation (p-value = 0.578).

It is important to emphasize that, even though the assumption of normality of the model is not met, the fulfillment of the homoscedasticity and autocorrelation assumptions is sufficient to accept the usability of the model [X113].

4.4. Similarity between regions according to the resources that influence the continuity of regular basic education, during the period 2021-2022.

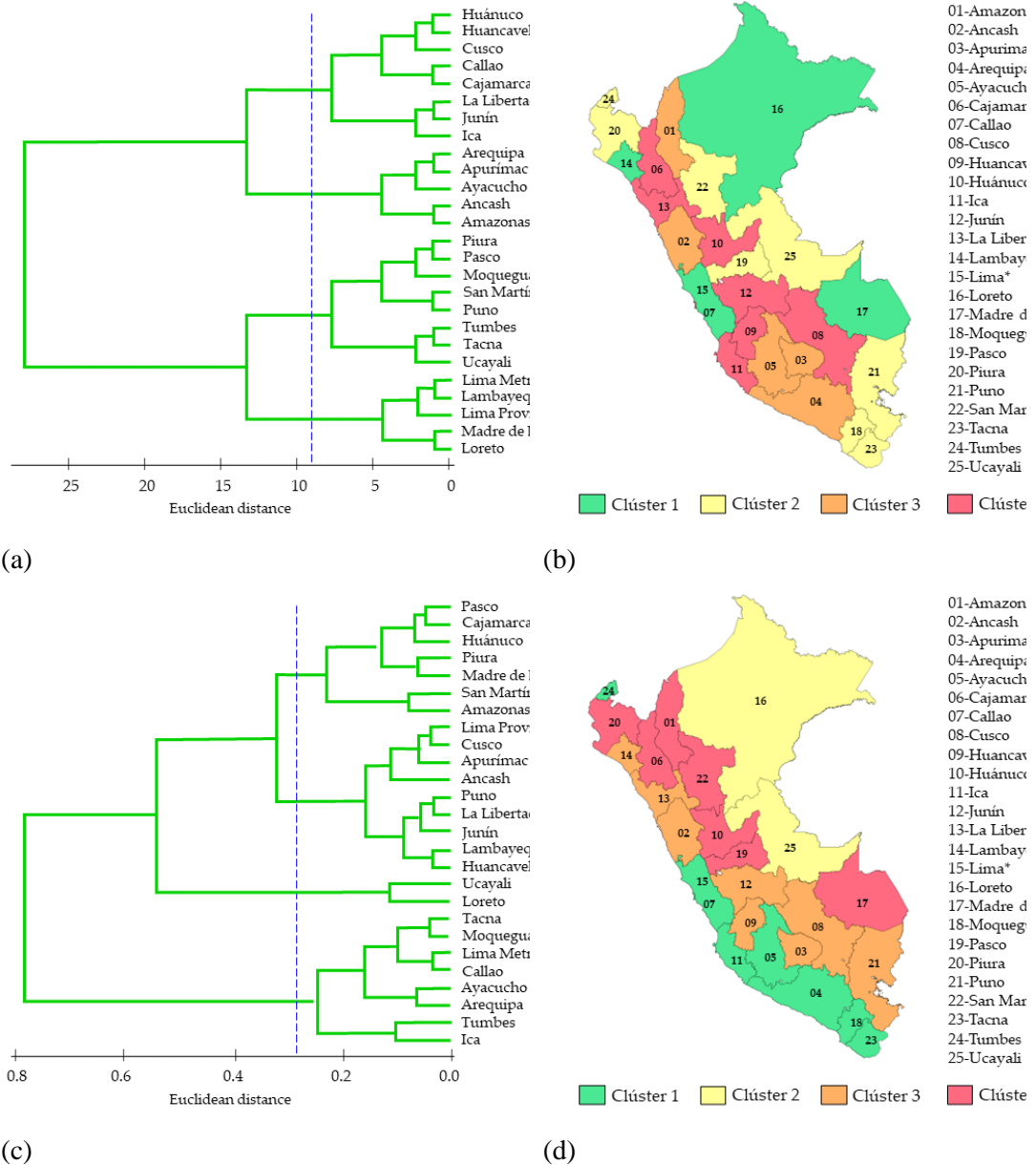


Figure 3. (a) Dendrogram for cluster identification in the year 2021, (b) visualization of the cluster for the year 2021. (c) Dendrogram for cluster identification in the year 2022, (d) cluster visualization for the year 2022. Note: 1 (\*) includes metropolitan Lima and Lima provinces.

By means of cluster analysis (Euclidean distance), four groups of regions with similarities were identified, according to hygiene services and vaccinated teachers, resources that influence the continuity of regular basic education in the 2021 period (Figure 3). The first cluster is made up of the regions of: Loreto, Madre de Dios, Lima Provincias, Lambayeque and Metropolitan Lima. The second cluster: Ucayali, Tacna, Tumbes, Puno, San Martin, Moquegua, Pasco and Piura. The third cluster: Amazonas, Ancash, Ayacucho, Apurimac and Arequipa. Finally, the fourth cluster: Ica, Junín, La Libertad, Cajamarca, Callao, Cusco, Huancavelica and Huánuco. Four clusters were also identified,

according to access to water, sewerage, internet and vaccinated teachers, resources that influence the continuity of regular basic education in the period 2022 (Figure 2). The first cluster is made up of the regions of Ica, Tumbes, Arequipa, Arequipa and Arequipa: Ica, Tumbes, Arequipa, Ayacucho, Callao, Metropolitan Lima, Moquegua and Tacna. The second cluster: Loreto and Ucayali. The third cluster: Huancavelica, Lambayeque, Junín, La Libertad, Puno, Ancash, Apurímac, Cusco and Lima Provincias. Finally, the fourth cluster: Amazonas, San Martín, Madre de Dios, Piura, Huanuco, Cajamarca and Pasco.

Table 9. Correlation of basic services and vaccination coverage indicators with continuity of regular basic education based on clusters.

Statistics	2021		2022		
	Toilets	vaccinated teachers	Drinking water	Internet	Vaccinated teachers
Spearman correlation	0.9456	0.474	0.9282	0.9331	-0.9282

\*p-value<0.05 (no normality test per period)

In the Table 9, for the year 2021, access to sanitary services shows a very high direct relationship with school continuity; however, it does not show a significant relationship with the coverage of vaccinated teachers. In the year 2022, access to drinking water and internet have a very high direct relationship with school continuity. Likewise, the coverage of vaccinated teachers has an inverse relationship with school continuity.

## 5. Discussion

The global crisis of COVID-19 had a considerable effect on RBE education systems worldwide, generating difficulties in the continuity of studies and in the learning of students, especially those in situations of greater vulnerability. A study in the European Union identified an average early school dropout rate of 9.9% [7,8,9]. In Latin America, of 740,000 Mexican students who dropped out, 97% of them failed to complete the school year due to pandemic-related causes [10]. In developing countries such as Peru, the pandemic represented a great challenge, as the State and society had to face the health, economic and social crisis with more marked structural limitations than other countries in the region. In Ecuador, more than 900,000 students dropped out not only because of health conditions, but also because of a lack of economic and pedagogical resources, highlighting the existing gaps in the education sector [11,12].

In Peru, according to the report of the Comptroller General's Office, more than 50% of the public educational institutions (I.E.), visited during the National Operation "Good start of the School Year 2022", presented problems in their infrastructure and lack of basic services. In addition, limited implementation of biosecurity measures against COVID-19 was observed. These deficiencies represented a risk for the return to face-to-face or blended learning of students [37]. This is reflected in Table 3, where it was identified that, by the year 2021, 62% and 55.3% of educational facilities nationwide had access to potable water and toilets in good condition, respectively. In view of this situation, a diagnostic process was carried out, aimed at redistributing the student population in order to comply with the mandatory social distancing during educational activities [38]. This process of adaptation for the implementation of the strategy generated that, on average, 34% of public educational institutions in the various regions of the country had access to drinking water. Some regions even reached 56% in terms of access to this service. In addition, these institutions achieved an average of 60% access to basic services such as electricity, 40% access to a sewage network and 30% access to the Internet. In certain regions, these percentages rose to 84% for electricity, 55% for sewerage and 43% for internet. These results were ratified by INEI indicators, which



reflected a general increase in access to basic services by 2022, from 33.55% to 39.28% compared to the previous year [39,40]. These results can be compared with those found in LATAM, where in 2022, it was identified that 16% of educational institutions lacked water services, 12% had no handwashing facilities, while 28% had limited handwashing services. Another study, in Ecuador, revealed that 26% of public schools lacked adequate water services, 28% did not have acceptable hygiene services and 20% lacked sanitation services. Likewise, in Mexico, during the 2020-2021 school year, about 61.7% of primary schools and 65.5% of secondary schools had access to adequate basic services [16,17]. These educational inequalities have significant repercussions and encompass various aspects of students' lives, as those who lack a basic education are more likely to find informal jobs with minimal income. In addition, interruption of studies leads to increased levels of poverty, increases vulnerability to violence, and increases the risk of teenage pregnancy [40].

On the other hand, due to economic difficulties, more than half a million RBE students from private educational institutions opted to switch to public institutions in the country. The highest period of migration occurred in 2019-2020, with 356,241 students switching from the private to the public education sector. This migration had as main causes the loss of jobs and the decrease in parents' income, which forced them to look for more economical options. Public educational services, being free of charge, became an attractive option for low-income families. Research conducted in LATAM countries, such as Venezuela, Ecuador, Colombia and northern Peru, highlighted economic factors as the main cause of school dropout [28,29,30,31,33]. One of the main concerns of the Peruvian educational community was whether the educational facilities would be able to accommodate the new students enrolled in the public sector once face-to-face classes resumed. However, the figures showed that the migration of students from the private to the public education sector slowed after the pandemic, as many students returned to private educational services, although not necessarily to the same educational institution in which they were previously enrolled. In 2018-2019, 18% of students returned to private educational services. In 2019-2020, 116,614 students returned to the private system at the close of 2022 (33%). Finally, for the 2020-2021 period, 45,592 students returned to a private educational service, representing 27% of the total number of transfers in that period [41]. The reasons for this return varied between: seeking better educational quality, changes in the school environment or personal preferences. The return somewhat relieved the pressure on the public system, since it allowed it to adequately meet student demand and focus on providing quality education. It also had a positive impact on the economy, since it implied the payment of tuition and pensions in private schools, which generated income for the educational institutions and potentially for the teaching and administrative staff. This may explain the results found in Table 4, where the percentage of educational continuity in 2021 is higher than in 2022, specifically in the regions of: Tumbes, Piura, Ancash, Lima, Callao, Huancavelica, Ayacucho, Apurimac, Puno, Moquegua and Tacna (Figure 1). In addition, this difference was evaluated using the nonparametric Wilcoxon Ranks test ( $W=445.5$ ,  $p\text{-value}<0.05$ ), which was statistically significant. Figure 2 shows that the proportions of continuity in both periods were homogeneous and identified Amazonas, Ucayali and Loreto as the regions with the lowest percentage of educational continuity, and in the year 2022, San Martín also became part of these regions. These results are based on the educational and economic sector indices shown in Table 5, where the regions of Loreto and Ucayali are in the penultimate and last position in the educational sector, respectively, with the lowest indices.

The return to semi-presential and face-to-face classes has been a complex and uncertain process due to the risk of contagion in educational institutions. Governments have responded in various ways to the health crisis and the spread of the virus. The adoption of policies and strategies such as "Seamos Comunidad", the "Estrategia Nacional" and the "Estrategia Nacional de Reinserción y Continuidad Educativa" in different LATAM

countries, such as Chile, Mexico and Peru, reflected the shared concern for maintaining educational continuity and reducing school dropout, through the collaboration of various sectors and the focus on providing a comprehensive support environment for students [20,26,27]. As a result, a heterogeneous scenario has taken shape regarding the reopening of RBE institutions [42]. Tables 7 and 8 show the multiple linear regression models for the periods 2021-2022, in these models we sought to identify the most influential resources on educational continuity. In this regard, it was found that, in 2021, access to basic services and the percentage of vaccinated teachers were the most influential resources for educational continuity, with internet access being added for 2022. This finding coincides with a previous study conducted in the town of Manta, Ecuador, which identified a close relationship between student dropout and the absence of connectivity [30]. In light of these results, there is a need for the Peruvian government to intensify its efforts to reduce the digital divide in the country [12,13,14].

In addition, a cluster analysis (dendrogram) was performed to evaluate whether there are groupings of regions with similarities according to the most influential resources mentioned in the previous paragraph. For example, for the year 2021, in cluster 1: Lambayeque, Lima (metropolitan Lima and Lima provinces), Loreto and Madre de Dios are the regions with the lowest percentage of continuity of students in RBE, the lowest access to sanitary services and the lowest percentage of vaccinated teachers. In cluster 4: Moquegua, Pasco, Piura, San Martin, Tacna, Tumbes and Ucayali are the regions with the highest percentage of continuity of students in RBE and the highest access to hygiene services. However, cluster 2: Cajamarca, Callao, Cusco, Huancavelica, Huánuco, Ica, Junín and La Libertad are the regions with the highest percentage of vaccinated teachers. By 2022, in cluster 1: Arequipa, Ayacucho, Callao, Ica, Metropolitan Lima, Moquegua, Tacna and Tumbes are the regions with the highest percentage of continuity of students in RBS, with greater access to drinking water and internet. In cluster 2: Loreto and Ucayali, despite having the highest percentage of vaccinated teachers, are the regions with the lowest access to drinking water and internet services and the lowest percentage of continuity of students in RBS.

Finally, it is important to highlight that the National Strategy for Educational Reinsertion and Continuity, implemented by the Peruvian government, has played a key role in reducing the negative effects of school dropout. In addition, this strategy has ensured the continuity of regular basic education, thus contributing to the achievement of the fourth Sustainable Development Goal in the field of education.

## 6. Limitations

The data used in this research were obtained from official secondary sources, which implies that the statistical results were based only on regional indicators provided by MINEDU. Information disaggregated by type of educational management (public and private) is not available to compare the different indicators. In addition, the same indicators are not available for both years (for example, there were only indicators for the distribution of face masks and face shields in 2021).

## 7. Conclusions

In terms of access to basic services, 70% of RBE educational institutions did not exceed 70% in both periods. On the other hand, the vaccination coverage of teachers and students was higher in 2022, demonstrating that only planned vaccination resources were executed more effectively.

The continuity of regular basic education is statistically different in the periods 2021-2022, this is due to the migration of students from private to public educational services

during the period of the pandemic; however, with the recovery of the economy, the migration figures from private to public post\_pandemic have been reduced, this allowed to meet the student demand, focus on providing quality education and generated a positive impact on the economy.

Access to basic services and teacher vaccination coverage were the resources that most influenced the continuity of regular basic education for the 2021 educational period, in addition to internet access for 2022. To date, the availability of basic services and adequate infrastructure of educational institutions is a limitation for public institutions in our country. Therefore, it is essential to establish public policies and educational strategies to reduce these gaps, giving priority to the regions with the greatest shortages. There are regions that present similarities according to the resources that influence educational continuity, which are grouped according to the percentage of access to basic services and internet access.

There are regions that present similarities according to the resources that influence educational continuity, which are grouped according to the percentage of access to basic services and internet access. This reflects that those regions that have greater access to these resources are those that present a higher rate of school continuity.

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