Analysis, Diagnosis, Prevention and Mitigation of Dropout Among Rural Undergraduate Students in Colombia.

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Abstract

Dropout in higher education has been a widely studied phenomenon, with a consensus on its potential to prevent the transfer of the personal and social benefits of higher education. In this context, it is recognised that rural student dropout in higher education has not been widely analysed, neither by states nor by the academic community. Hence, the Colombian case is not an exception to this reality, where public policies have made efforts to prevent and mitigate it by seeking to facilitate access to education through funding, as well as to strengthen and develop the skills of rural students that should have been acquired at previous academic levels. Despite this, dropout levels remain high, and with the effects of COVID-19 are expected to increase. Furthermore, this generates indications that there are explanatory variables and causes that have not been addressed by the State and Higher Education Institutions (HEIs) for the correct treatment of this educational phenomenon.

Thus, the objective of this thesis was to establish which strategies in the framework of Colombian public policies should be implemented by the State and HEIs for the analysis, diagnosis, prevention, and mitigation of dropout in students located in or coming from rural areas enrolled in undergraduate programmes, through the development of models. A mixed methodology, incorporating both qualitative and quantitative methods, was proposed for the fulfilment of this objective. The study began with a documentary review to contextualise public policies on access to higher education, as well as those on retention and timely graduation. Subsequently, a model based on system dynamics was developed with the aim of understanding the economic effects of dropout on the actors at the educational level. With this framework, we proceeded to identify other explanatory variables influencing dropout in the rural student population through a systematic review of the literature and cluster modelling. Finally, a systems thinking model was developed based on the narratives of rural students who intended to drop out or had dropped out.

The thesis presented here developed a first comprehensive analysis of dropout in rural higher education in Colombia, framing new perspectives for the development and complementation of existing public policies, based on the identification of the explanatory variables and causes that lead students to end their training process early. In general terms, advances were made in the field of knowledge regarding the study of public policies, simulation modelling applied to the field of education, the characterisation of students who drop out and those who intend to drop out, as well as those who intend to remain, and, finally, the establishment of the causes of dropout in the student population under study.

Keywords: dropout, higher education, rurality, modelling, students, higher education institutions, State.

Introduction

It has been established that access to education in a generalised manner entails a series of benefits that make it possible in the short, medium and long term to overcome the social disparities that exist in different countries, since it makes it possible to improve the income level of the population (Cristia & Pulido, 2020; Montenegro & Patrinos, 2014), increase the productivity of nations (McMahon, 2010), reduce crime levels (Chalfin & Deza, 2019; Lance, 2011) and raise the quality of life (Davies, 2001; Lance, 2011), among others. Thus, education becomes a factor in overcoming the extreme inequalities experienced in developing countries by realising the benefits of its implementation (Cristia & Pulido, 2020).

In this context, the Colombian state is not indifferent to the development of policies that facilitate access to the education system, from primary school to higher education. However, it must be recognised that their implementation has had many difficulties, especially in rural areas, where geographical heterogeneity, population diversity and differences in the historical context, together with the disparity in territorial development and the influence of insurgent groups have hindered the implementation of this type of policy (Amaya de Ochoa, 2002; United Nations, 2021).

In relation to access to higher education, the 1991 Political Constitution and the 1994 General Education Act established the framework for rural populations to have access to this level of education, so that the Colombian Ministry of National Education, as the governing body of the country's education policy, has implemented various strategies to realise the benefits described above, among which the following stand out: distance education, technical and technological training, education for work and the Rural Higher Education Centres (known as CERES in Spanish). More recently, two strategies have been proposed to allow the rural population in Colombia access to higher education: the first relates to "adaptable educational models" incorporating three components in their development; and the second corresponds to the creation of special credit lines for students from rural areas.

Thus, in the case of the first one, the aim was to facilitate access to higher education based on the following components:

1. The levelling of competencies and articulation with secondary education: this corresponds to the increase in the transition from secondary to higher education, through the strengthening of basic competencies, socio-occupational orientation and monitoring of the entry phase to HEIs.
2. Recognition of knowledge and competences: HEIs and the National Apprenticeship Service (SENA) in their training process must contemplate tests of sufficiency of previous knowledge that allow them to validate these within the training programmes.
3. Flexible modalities of relevant and quality offerings in higher education and education for work and human development (ETDH): establishes the relevance of distance, virtual and blended modalities, as a way to allow the transition of students from secondary to higher education, facilitating decentralisation and reducing the need to change domicile to access education. Together with a process of educational quality on the part of the MEN that allows not only the development of competencies but also the permanence and graduation of this population.

In this way, adaptable educational models and, more specifically, the so-called flexible models seek to promote inclusion and equity through processes that are adjusted to the needs of the territories (Ministry of National Education of Colombia, 2018), so that their implementation seeks to expand the educational offer, allowing the design of a proposal in accordance with the demands of rural populations.

The second strategy corresponds to the creation of forgivable credit lines for both tuition and student maintenance. The Colombian Institute for Educational Credit and Technical Studies Abroad (ICETEX) designed these lines of credit, notably: "Ser Pilo Paga", "Generación E" and "Más Colombiano Que Nunca" (More Colombian than ever). Under these lines, the overall goal was to provide access to higher education to more than 105,000 students located in rural areas, in addition to increasing the coverage rate in these areas from 22% to 40% (Ministry of National Education of Colombia, 2018).

In this scenario, it must be recognised that it is not only enough to guarantee access to higher education in rural populations, but also that it is imperative to achieve retention and timely graduation, which is why dropout becomes an impediment to transmitting the benefits of education to these areas (Guzmán et al., 2021b). This educational phenomenon becomes an object of study by states, higher education institutions (HEIs), students and their families, the productive sector, and society in general, due to the capacity of this phenomenon to impede the realisation of the personal and social benefits of education in rural areas, as well as to accentuate the social disparities experienced in these areas.

The impact of dropout at the tertiary level has been widely documented (e.g.: Hällsten, 2017; Sosu & Pheunpha, 2019; Moreno et al., 2019; Ghignoni, 2017; Voelkle & Sander, 2008; Ortiz & Dehon, 2013; Barragán & Rodríguez, 2015; The World Bank, 2017; Cristia & Pulido, 2020; Lance, 2011; Chalfin & Deza, 2019), as well as possible forms of prevention and mitigation (e.g.: Pokhrel & Chhetri, 2021; Dennis, 2020; Mailizar et al., 2020; Tinto, 1987; Barragán and González, 2017; Segovia-Garcia and Said-Hung, 2021), these are concentrated in a student profile not related to rurality, which can lead to the fact that such prevention and mitigation strategies have no effect on the student population, or that their scope is limited for the treatment of this problem in rural areas, hence the need for a holistic vision to understand dropout in rural higher education.

In the case of Colombian rural higher education, the dropout rate per cohort was close to 50%, both for technical and technological programmes and for the university level (Ministry of National Education of Colombia, 2018). In this sense, the statistical information available in the Special Rural Education Plan (PEER in Spanish) shows that the department with the highest annual dropout rate in rural areas was Cesar with 47.4% for technical and technological programmes, and Putumayo with 15% for university programmes. In terms of dropout by cohort, the departments of Chocó, La Guajira and Putumayo had the highest levels of dropout for technical and technological programmes with 91.3%, 73% and 71.2%, respectively, while for university programmes it was Putumayo, La Guajira and Arauca with 80.2% and 55.6% for the latter two.

Dropout at the higher education level in rural areas is explained in the Colombian public policy framework by the low academic performance of students in these areas at previous levels; and, by the economic conditions of these areas (Ministry of National Education of Colombia, 2018). For these reasons, state efforts have concentrated on financing tuition fees and other associated costs, as well as requiring HEIs to develop welfare programmes that allow for the development and strengthening of competences. Although these strategies are coherent with the causes from which

they derive, dropout is a complex phenomenon that is not limited only to the academic performance prior to higher education and the economic problems of the students, so it is necessary to identify and incorporate other explanatory variables that are not described in the framework of current public policies and that may influence the student's decision to abandon their educational process. This is necessary in order to undertake actions that allow analysis, diagnosis, prevention and mitigation in an effective and efficient way in rural populations, since it can affect causes that are not relevant to the problems of these areas.

However, it must be recognised that the failure to deal with this problem represents high costs for students and rural families, HEIs and the country. In the case of students, these costs are associated with the impact on learning factors such as emotion, cognition, motivation, among others; In addition to the economic effects for the dropout in the framework of PEER and the Rural Plan for Higher Education, since the main means of financing are the forgivable loans that must be paid, with interest, if the training programme is not completed, affecting the levels of indebtedness and, consequently, aggravating the financial condition of the student and his family, which represents a sunk cost for these (Moreno et al. , 2019). Although, for some students, dropping out can mean a positive change by allowing a professional reorientation, this is not a generality, especially in rural areas where access to this level of training is limited in terms of academic offer and opportunities for linking to HEIs.

For HEIs, attrition represents difficulties in their mission or substantive functions, as this phenomenon is associated with a quality condition for academic programmes, given that the National Council of Higher Education (CESU) incorporates its control and mitigation, by referring that "The academic programme must (...) develop programmes and actions, and achieve results that promote the permanence and graduation of students with reference to institutional and national policies" (2020, p. 27). In this sense, it is the duty of institutions to characterise their students, including the broad spectrum of explanatory variables of each of the determinants in Figure 4, in order to design programmes, plans and actions according to the profile and conditions of the student body. In addition, dropout directly affects the income of HEIs in terms of enrolment, since it represents an opportunity cost that translates into the loss of financial support, especially those of a private or mixed nature (Bean, 1986; Barragán & Rodríguez, 2015).

Finally, for the country it represents an economic loss because productivity cannot be increased through the generation of new skilled labour; and, the difficulty of collecting the resources delivered by forgivable credits, because part of the beneficiaries will not be able to pay their debt. This may result in the defunding of the plans and programmes set out in the PEER and the Rural Higher Education Plan. In addition, the materialisation of dropout generates the detriment of municipal and regional resources for food, transport and housing. In this context, the World Bank stated that "(...) students who do not graduate on time (or at all) when they receive public funding consume valuable fiscal resources which in many cases are not recoverable" (World Bank, 2017, p. 14).

Considering the generalised unawareness of other variables that explain dropout in Colombia in rural higher education and given the limited analysis of this educational phenomenon by the academic community in this student population, as contemplated in the work of Guzmán et al. (2021a), the need arises to analyse and discuss the scope of current policies, their effects, the variables that influence dropout, its causes and the strategies for its prevention and mitigation. Hence, the aim of this thesis was:

To establish which strategies within the framework of Colombian public policies should be implemented by the State and HEIs for the analysis, diagnosis, prevention, and mitigation of dropout among students located in or coming from rural areas enrolled in undergraduate programmes, by means of the development of models.

General remarks

Due to the complexity of dropout in which various actors and levels of decision-making interact (Barragán & Lozano, 2022; Guzmán et al., 2021b; Xavier & Meneses, 2020; Arias-Velandia et al., 2018; Donoso & Schiefelbein, 2007), and, especially, in the conditions of rural students in higher education, this thesis did not seek to adopt a single definition of dropout, but on the contrary, in each of its chapters it sought to recognise the diversity of points of view resulting from state, academic and modelling conceptualisation, which allow for the discovery of new findings and the enrichment of the discussion, aimed at providing a greater understanding of the phenomenon studied here in the rural population.

Having said this, dropout was understood as an event from the duration or survival models, in which the relationship of the time elapsed between a student's entry into higher education until he/she drops out (the event occurs) is analysed (Singer & Willett, 1993). The analysis of these elements requires the definition of specialised functions that account for how dropout develops, when it is most likely to occur, when it is most at risk or what the most influential variables are. This point of view is the one addressed by the Colombian Ministry of National Education for the analysis of student dropout and the development of public policies aimed at its diagnosis, prevention and mitigation at the higher education level.

On the other hand, dropout from the perspective of system dynamics was approached as a complex system due to delays, the non-linearity and the multiple feedback loops that occur between variables (Barragán, 2017; Barragán & Cala, 2018). However, this was also considered a phenomenon from the perspective of graph theory and decision trees (Barragán & González, 2017).

Another aspect to consider was the meaning of rurality, where for the Colombian case, it is defined according to the number of inhabitants living in the municipal capital and the population density represented by the number of inhabitants per square kilometre (hab/km^2). In this way, these zones are classified into two: the first one called rural, referring to those municipalities that have between 25,000 and 100,000 people in their municipal capitals and intermediate population densities (between 10 hab/km^2 and 100 hab/km^2); and the second one, called rural dispersed, which is made up of municipalities and non-municipalised areas with less than 25,000 inhabitants and population densities of less than50 hab/km^2 (National Planning Department, 2014). In the case of higher education, both the Colombian Ministry of National Education and the Colombian Institute for the Evaluation of Education have based the development of their plans and programmes on this definition.

Finally, each of the chapters that make up this thesis for the PhD in Modelling in Public Policy and Management has been published or is in the process of being submitted to SCOPUS-indexed journals. The following is a description of each of chapters:

The first chapter is entitled *Rural Higher Education In Colombia: A Public Policies Evolution Analysis*, which aims to describe the evolution of public policies for access to rural higher education in Colombia, as well as the starting point of the policies implemented. It is currently

being submitted to the journal Latin American Policy, ranked in the third quartile (Q3) in the Scimago ranking.

The second chapter is entitled *Rural Population And COVID-19: A Model For Assessing The Economic Effects Of Drop-Out In Higher Education*, which sought to model the economic effects of rural student dropout at the higher education level for students and their families, Higher Education Institutions (HEIs) and the state, based on public policies for access to higher education, in the pandemic and post-pandemic scenario. It was published in the journal Frontiers in Education, ranked in the second quartile (Q2) of the Scimago ranking.

The third chapter is entitled *Dropout In Rural Higher Education: A Systematic Review*, which aimed to identify the individual, socio-economic, academic and institutional explanatory variables involved in higher education dropout in rural populations, based on a synthesis of the evidence available in the SCOPUS database. The article was published in the journal Frontiers in Education, positioned in the second quartile (Q2) of the Scimago ranking.

The fourth chapter is entitled *Rurality And Dropout In Virtual Higher Education Programmes In Colombia* and aimed to identify which individual, institutional, academic and socio-economic characteristics influence the dropout of rural students in virtual undergraduate programmes in Colombia. The article version was published in the journal Sustainability, ranked in the first quartile (Q1) of the Scimago ranking.

The fifth chapter is entitled *Comparative Analysis Of Dropout And Student Retention In Rural Higher Education*, which sought to identify which individual, academic, socio-economic and institutional variables influence the dropout and retention of rural students in higher education. The article is currently being submitted to the journal Sustainability, which belongs to the first quartile (Q1) of the Scimago ranking.

The sixth and final chapter is entitled *Dropout In Rural Higher Education: Analysis Of Causes From Systemic Thinking*, which aimed to establish the causes of student dropout in rural higher education using a conceptual model based on systems thinking. The article version was published in the journal Qualitative Research in Education, ranked in the second quartile (Q2) of the Scimago ranking.

Chapter One: Rural Higher Education in Colombia: A Public Policies Evolution Analysis

Public policies on access to higher education had a first turning point in the 1990s in Colombia, when they sought to democratise access, with the emergence of Law 30 of 1992 and Law 115 of 1994, as well as the ten-year education plans. More recently, with the signing of the peace agreement, the state has made a commitment to develop a comprehensive policy to guarantee access, permanence, and timely graduation from education for rural populations. This chapter discusses the evolution of rural higher education access policies, the starting point of post-peace agreement policies and the strategies being implemented to achieve permanence and timely graduation.

Abstract

Education can be seen as a driver for social development because with a higher level of education, better income and a better quality of life can be accessed. In support of this premise, the Colombian state has proclaimed various public policies that guarantee this right, especially for rural populations who are the least favoured by the disparities resulting from the internal armed conflict and drug trafficking, among others. The purpose of this chapter was to describe the evolution of public policies for access to rural higher education in Colombia, as well as the starting point of the policies implemented. To this end, an interpretative method was adopted to recognise the purpose of public policies from various perspectives. As a result, education can be perceived as one of the ways in which states can overcome the social disparities in rural areas, resulting in different public policies for access, permanence, and timely graduation to higher education.

Introduction

In numerous international agreements, education has been consolidated as a tool to achieve the development of society because of the benefits of its massification among a given population. In this regard, studies have shown that people with a higher level of education tend to have higher incomes, which is represented by higher rates of return on investment with an estimated return of 10% for a person with a basic primary education, 7% for a secondary education and 15.2% for a higher education (Montenegro & Patrinos, 2014). Additionally, it is recognized that a higher level of education not only increases people's income, but also has a positive impact on their quality of life; since the higher this level is, the more complex information related to their health can be processed leading them to acquire and develop better habits, eliminate self-medication, and take medical treatment correctly, among others; all of which increases the life expectancy of the population (Lance, 2011; Davies, 2001).

In addition, education improves various social aspects related to the well-being of the population, including the reduction of crime, the strengthening of democracy and the benefits of an intergenerational nature. In the case of crime, it has been observed that the more studies an individual has, the less likely he or she will be to commit criminal acts, given that he or she will reflect on the opportunity costs, the effects of the financial and psychological rewards derived from crime, the possible risks derived from criminal behaviour, in addition to changing his or her relationship with their social circle of influence (Chalfin & Deza, 2019; Lance, 2011; Castellar & Uribe, 2004). About democracy, it has been considered that a more educated population makes informed electoral decisions, without implying that they are good or bad, but rather that they tend to seek information about candidates for elected office, the development of public policies, laws, etc. (Lance, 2011; McMahon, 2010; Swail et al., 2003; Castellar & Uribe, 2004; Lipset, 1959). Finally, in the intergenerational benefits, it can be named the capacity to build social capital in long terms. A higher level of parental education implies that their children will have a similar or higher

level of education than the one achieved by their parents which intensifies the economic and social effects of education (Guzmán et al., 2021b; McMahon, 2010).

Moreover, the Colombian State has recognized education as one of the ways to overcome the disparities existing in the social context of the country. For that reason, various public policies have been issued to assure access to education by the population, especially those in a condition of vulnerability, among which the rural populations are present (CEPAL, 2016; Perry, 2010; National Planning Department, 2007). Thus, the Political Constitution of Colombia established that "education is a right of the individual and a public service that has a social function; it seeks access to knowledge, science, technology, and other goods and values of culture (...)" (Congress of the Republic of Colombia, 1991). According to this mandate, the State has the obligation to respond to the four dimensions that make up the duality of this right - also considered a public service. The first concerns with the availability of the service which must create and support sufficient educational institutions to make them available to all those demanding to enter this system; the second refers to adaptability, in which the role of the central government is to adapt education to the needs and demands of the learners and to guarantee the provision of the service; The third relates to acceptability, in which the quality of the education provided must be ensured; and the fourth responds to accessibility, which consists of the obligation to guarantee everyone in equal conditions to facilitate, as far as possible, access to the service from a geographical and economic point of view (OECD, 2018a; Mendoza et al., 2013).

Although the State's obligations are defined regarding this right, it has not been possible to fulfil them in rural areas since geographical heterogeneity, population diversity and differences in the historical context, along with the disparity in territorial development, have made it difficult to provide public services (Ministry of National Education of Colombia, 2018; Ministry of National Education of Colombia, 2017; United Nations Development Programme, 2015; Amaya de Ochoa, 2002). In this scenario, the General Education Law was passed in 1994, declaring that both the National Government and the territorial entities will promote the service of peasant and rural education, formal, non-formal and informal, in accordance with the respective development plans (Congress of the Republic of Colombia, 1994). The creation of this framework for the implementation of plans and programmes aimed at the population located in rural areas related to education, which includes the higher level.

In this sense, since this law, several public policies have been designed to facilitate access to higher education; however, their analysis has been incipient. Thus, the studies carried out are conglomerated in two main areas; the first one refers to the presentation of the higher education policy which covers some elements of its implementation in the countryside as for example the study carried out by Avendaño et al. (2017) which focus on their efforts on describing its general evolution, the emergence of ten-year education plans and their slight impact on rural areas. The second one describes the education policies in rural areas, from the basic primary level to the higher one, characterized by giving a holistic vision of the education system in those areas, without providing details on certain aspects of this educational level (Arias, 2017). Similarly, in the international literature, the analysis of public policies for access to higher education in rural areas has not been studied in depth, but it has been concentrated on the fact of comparing the effects of this type of policy after its implementation in order to know if the gap with urban areas has been reduced, if it has improved living standards through the materialization of the benefits of educational level, among others (e.g.: Chankseliani et al., 2020; Mgqwashu et al., 2020; Trahar et

al., 2020). In this way, there is not an exclusive line of action to carry out an exhaustive analysis of public policies for access to higher education in relation to rural areas.

From this context, the research questions in this article were: how have public policies for access to rural higher education in Colombia evolved? and what is the starting point for current policies? in favour of answering the research questions, a qualitative methodology was defined, taking into consideration the period concerning from 1993 to 2020 as the time frame. To this end, the work developed by Pino (2017), who compiled the various methods used for the analysis, evolution and evaluation of public policies was considered. Thus, the present article adopts an interpretative method, in which narrative analysis takes on relevance, to recognise the object of public policies from different perspectives without favouring one over the others and without classifying the good or bad aspects of these appreciations (Barreto et al., 2010).

This method has as its central axis not only the determination of the relevant elements for policies, but also their meaning, for that reason the role of the analyst or researcher is preponderant (Yanow, 2007). Bearing this context in mind, the present work is inscribed in the school of hermeneutics through the analysis of texts, focusing on those considered relevant to the development of the study.

Consequently, this article is divided into five sections. The first section provides a contextualisation of higher education in Colombia; the second section describes the analysis of policies in the conflict and post-conflict phase; the third section shows the starting point of the current rural higher education policy; the fourth section discusses the results; and finally, the fifth section discusses the conclusions of the study.

Context of higher education public policies in Colombia

The public policy of higher education in the country has its formal origin in the middle of the 20th century, however, it must be recognized that the system was configured previously, so the foundations of this policy go back to the 16th, 17th, and 18th century with the founding of the first university cloisters led by religious orders (Avendaño et al., 2017; Rodríguez et al., 2009). In the first years of the nascent republic, the central and public universities were founded, whose main purpose was to train professionals for the construction of the state (Melo-Becerra et al., 2017). But it was not until the governments of Tomás Cipriano de Mosquera and José Hilario López between 1861 to 1853 that higher education moved away from the ecclesiastical approach, giving rise to an era of liberalism in education (Melo-Becerra et al., 2017), which was consolidated with the Political Constitution of Rio Negro, which defined the financing of education by the State (Silva, 1989).

These policies would continue until the period known as the Regeneration of the State, constituted between 1886 and 1903, which was the result of a series of economic, political, and social reforms that consolidated the unity of the Republic after the 1886 Constitution (Monroy, 2012). This period was characterised by the return of the conservatives to power, who eliminated the liberal reforms carried out in higher education limiting university autonomy and leaving the control of the institutions in the hands of the government (Silva, 1989).

In the 20th century, due to the different circumstances experienced at the beginning, especially the Thousand Days War, as well as Panama's independence, higher education policy did not make much progress and was characterized by church interventionism. However, it was not until the government of Alfonso López Pumarejo, which a turnaround in the country's education policy began. It sought to strengthen the links between academic education and economic reality

which resulted in the creation of universities in intermediate cities (Melo-Becerra et al., 2017; Jaramillo, 1989). In 1957, priority was given to technical and technological training, which led to the creation of the National Learning Service (SENA for its acronym in Spanish). But it was not until the 1960s, when educational missions led by the International Labour Organization (ILO) exposed the shortcomings of the national education system (Lerma, 2007). This led the government to rethink aspects of the system, and especially its actions to increase coverage levels in the cities, in response to the urbanisation process that began under the Gustavo Rojas Pinilla's government (Yunis, 2003). As a result, from 1960 to 1980, the number of places in the institutions of higher education (HEIs) increased from 20,000 to 300,000 (Arvone, 1978) However, during this period authors such as Arvone (1978), Rodríguez et al. (2009), argue that the strong interventionism of international entities such as the United Nations Educational, Scientific and Cultural Organisation (UNESCO), the United Nations Development Programme (UNDP) and the World Bank did not allow the development of a comprehensive higher education policy, as they concentrated all state efforts only on the provisions of coverage.

This picture would change in 1991 with the National Constituent Assembly. This new political charter established several provisions not covered in its predecessor, such as the dual nature of the right to education, freedom of education, the role of inspection and monitoring by the state to ensure the quality of education and university autonomy (Melo-Becerra et al., 2017, Avendaño et al., 2017). Despite being enshrined in the constitution, changes in higher education policy were not immediate until Law 30 of 1992, which set out the path for operationalising the principles manifested in the constitution. This law became the normative basis for the level of education, defining the principles and objectives of this type of education, the formal education programmes, as well as the statutory differentiation between public and private HEIs. Additionally, this law defined the Ministry of National Education of Colombia and the National Council Education (known in Spanish as CESU) as the governing bodies of higher education.

From the point of view of this regulatory framework, together with the General Education Law, the construction of the ten-year education plans began, which was the first long-term policy involving all levels of training (Avendaño et al., 2017).

From 1991 to 2016: Period of conflict

In the first decade of the new millennium, technical and technological education continued to be strengthened, in addition to the creation of the Vice-Ministry of Higher Education. But it was not until 2014, when the CESU developed the first education policy exclusively for the training level, called "Agreement for the Higher 2034. Proposal for a public policy for the excellence of higher education in Colombia in the scenario of peace". This proposal sets out 10 guidelines which seek to cover various issues such as inclusive education, in terms of access, permanence and graduation, quality and relevance of the training level, among others. This policy was part of the Peace Agreement signed in 2016 and was the basis for the Special Plan for Rural Education (known as PEER in Spanish) and the Rural Higher Education Plan which gave rise to the current rural higher education policy.

The origin of the rural higher education policy was the General Education Law in 1994, which established the importance of this level as the axis of rural development. Thus, the Ten-Year Education Plan 1996–2005 mentioned "the search for equity and social justice. The overcoming of inequalities of access and permanence in the education system. Ensuring that the poorest groups and populations in rural areas have access to secondary and university education" (Ministry of

National Education of Colombia, 2006, p. 14). However, the State did not define clear strategies to achieve this end, so the gap regarding this level of education remained.

The Ten-Year Education Plan 2006–2016 already instituted the strengthening of this educational level for technical and technological levels, thus seeking "to integrate technical and technological institutions with basic, secondary and university education that will favour access, permanence, territorial rooting and work in rural and special groups" (Ministry of National Education of Colombia, 2006). In addition, higher education was decentralised to provide relevant programmes for marginalised urban, rural, and ethnic groups. Thus, for this period, 208 Rural Higher Education Centres (CERES in Spanish) were created of which 73% were in municipalities where there were no HEIs. Despite this, their contractual ineffectiveness and lack of control by the Ministry of National Education of Colombia led to a redefinition of the regionalisation strategy for higher education (Ministry of National Education of Colombia, 2017), focusing on the provision of terminal programmes that do not involve student mobilisation, promoting flexible higher education provision (distance or virtual education), the latter being broadly covered in the Ten-Year Education Plan 2016–2026.

Post-conflict period

In the framework of the peace agreement entitled "final agreement for the end of the conflict and the construction of a stable and lasting peace", the national government committed itself to developing a Comprehensive Rural Reform, which will seek "to overcome poverty and inequality in order to achieve the well-being of the rural population; and on the other hand, integration and the closing of the gap between the countryside and the city" (Presidency of the Republic of Colombia, 2016, p.32). Thus, this agreement contemplates that, in pursuance of overcome poverty, to improve family income was not sufficient; in fact, ensuring access to basic public services for the rural population, one of which is education was also needed.

Based on the above, in 2018 the Ministry of National Education of Colombia formulated the PEER and the Rural Plan for Higher Education articulated with the "Agreement for Higher Education 2034", which specified a series of actions aimed at access and permanence of the student population in vulnerable conditions, including those located in rural areas. The objective was defined as "closing the gaps in access and quality of education, between individuals, population groups and regions, bringing the country closer to high international standards and achieving equal opportunities for all citizens" (Ministry of National Education of Colombia, 2018, p. 126). Three strategies were established to achieve it. The first, called "Adaptable Educational Models", sought to generate inclusion and equity, so that people living in rural areas can have access to higher education through processes that are tailored to the specific needs of the territories (Ministry of National Education of Colombia, 2018). Thus, the following components were proposed:

1. The levelling of competences and the articulation with secondary education: this corresponds to the increase in transit from secondary to higher education, through the strengthening of basic competences, socio-occupational orientation, and follow-up to the phase of entry to the HEIs.

2. Recognition of knowledge or skills: this refers to the knowledge of doing by the rural population which, by means of a qualification plan, must be recognised by the HEIs and the SENA within their training process.

3. Flexible modalities of relevant and quality provision in higher education and education for work and human development (Known as ETDH in Spanish): establishes the relevance of distance, virtual and blended learning modalities as a way of enabling the transition of students from secondary to higher education, facilitating decentralization and eliminating student mobilization. This is in addition to a process of educational quality by the Ministry of National Education of Colombia that allows not only the development of skills but also the permanence and graduation of this population.

In the latter, the main advances have been made by the State, by defining new guidelines for both the application and renewal of qualified programme registrations, adapting them to the modality in which they are taught and the type of HEI through Decree 1330 of 2019.

The second strategy corresponds to the access to higher education, through creation of credits that can be waived for both enrolment and support of the rural population. In this way, the Colombian Institute for Educational Credit and Technical Studies Abroad (Known as ICETEX in Spanish) will establish special credit lines. In this sense, the second government of Juan Manuel Santos Calderón developed the "Ser Pilo Paga" programme, which was the first approach to this in the country. The first one, called "Generación E", replaced by "Ser Pilo Paga" and its objective is the social transformation and development of the country's regions through the access, permanence and graduation of young people in conditions of economic vulnerability in programmes in the country's public HEIs (Ministry of National Education of Colombia, 2020); and the second, within the framework of the programme "Mas Colombiano Que Nunca" (More Colombian than Ever), which seeks to give credit to students from special departments and districts with low coverage in higher education (e.g.: Amazonas, Arauca, Cauca, Cesar, Caquetá, Chocó, Buenaventura Port District, etc.) to carry out programmes in virtual mode.

The third and last strategy is the strengthening of capacities for the rural development of the territory and the consolidation of peace, which corresponds to the articulation of the HEIs, the productive and social sector for the promotion of research and innovation, the strengthening of the physical and technological infrastructure, and the labour insertion of students. In this sense, the creation of the Rural Alliances for Education and Development (RAED) is seeking for:

1. the expansion of higher education coverage for the rural population, through the design of relevant and flexible offerings.

2. the promotion of the definition of relevant and adaptable offer to the needs of the territory.

3. the creation of funding mechanisms for access to higher education for rural people.

4. the encouragement of vocational training for women in disciplines that are not traditional for them (Ministry of National Education of Colombia, 2017).

Thus, the overall goal of PEER was to bring over 105,000 students from rural areas into higher education and to increase the coverage rate in rural areas from 22% to 40% (Ministry of National Education of Colombia, 2018).

Starting point for rural higher education policy

The National Development Plans (NDP) incorporate the government's policies, in terms of relevant issues for the country (e.g.: economic growth and closing gaps) (Mejía et al., 2020). Nonetheless, it happens that:

During the discussion in Congress of the NDP drafts law, there is a substantial increase in the number of articles that compose it, which ends up distorting, even more, the Plan of its main objective, which should not be other than defining and prioritising the objectives and, public policies of the current government (Mejía et al., 2020, p. 1).

It should be noted that in all the development plans from 1990 onwards, education is found as an opportunity to close the social gaps and existing inequities, however, education, in general, appears as a priority only in the Base documents for the Plans. "National Development Programs in Change to Build Peace" (1998-2002) and in "Everyone for a New Country: Peace, Equity and Education" (2014-2018) (Mejía et al., 2020). In specific terms of education in rural areas, traditionally, the emphasis has been on basic (primary and secondary) and secondary education with few direct approaches to higher education, finding references to technical education or to work (National Planning Department, 1991; National Planning Department, 1995; National Planning Department, 1999; National Planning Department, 2003; National Planning Department, 2011; National Planning Department, 2019).

Just like that, rural higher education policy is relatively recent, and it was the result of the signing of the peace agreement between the government of Juan Manuel Santos Calderón and the FARC-EP. In this regard, it is important to recognize what the current state of the rural population is regarding this level of education, to be able to evaluate future progress in its implementation.

Firstly, concerning to secondary education, which is the immediate target population of higher education, there was a decrease in student coverage in rural areas, according to figures from the System of Student Enrolment in Basic and Secondary Education (known as SIMAT in Spanish) for 2016, of the total population of the country in grade eleven, only 15% belonged to these areas, in addition to the downward trend in the number of students enrolled in that level of education which, by 2015 was 25% (Ministry of National Education of Colombia, 2018; Ministry of National Education of Colombia, 2017). In addition, the immediate population with access to higher education in rural areas is characterised by low performance on the "Saber 11" tests, which are a requirement for entry to this level of education. In this sense, it is recurrent that most of the students in these areas reach the minimum performance in all the competencies evaluated by this exam (critical reading 61%, mathematics 67%, natural sciences 84%, social and citizen sciences 83% and English 92%) (Colombian Institute for the Evaluation of Education, 2019). However, it should be recognised that the results of these tests show a slight significant improvement in critical reading and mathematical competencies, as shown in Figure 1. Percentage of population with low performance by competition in rural areas. Figure 1.

The immediate transit rate, which corresponds to the student population that immediately completes their secondary education to higher education, has historically been lower in the rural population. Thus, by the year 2016, 22% of the population that graduated in rural areas immediately entered technical, technological, or professional training programmes (CEPAL, 2016; Ministry of National Education of Colombia, 2006).

Secondly, in the case of those indicators related to higher education, there is evidence of a high concentration of educational provision in urban centres, which makes access to higher education difficult for the rural population. In this sense, 65% of the students enrolled in HEIs by 2018 were concentrated in the departments and special districts with the highest urbanisation rate as Bogotá (32.96%), Antioquia (13.95%), Valle del Cauca (7.37%), Atlántico (5.56%) and Santander (5.30%) (Ministry of National Education of Colombia, 2019). Currently, in the

departments with the lowest rate of urbanisation, enrolment is concentrated in the departmental capitals, which makes clear the concept of the periphery of the periphery.
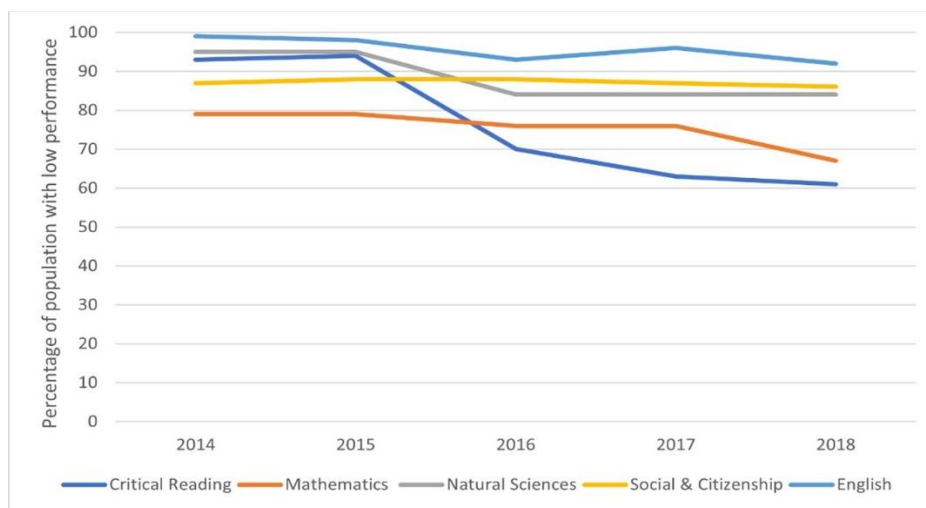
Figure 1. Percentage of population with low performance by competition in rural areas.
Source: Colombian Institute for the Evaluation of Education (2019) and Colombian Institute for the Evaluation of Education (2018).
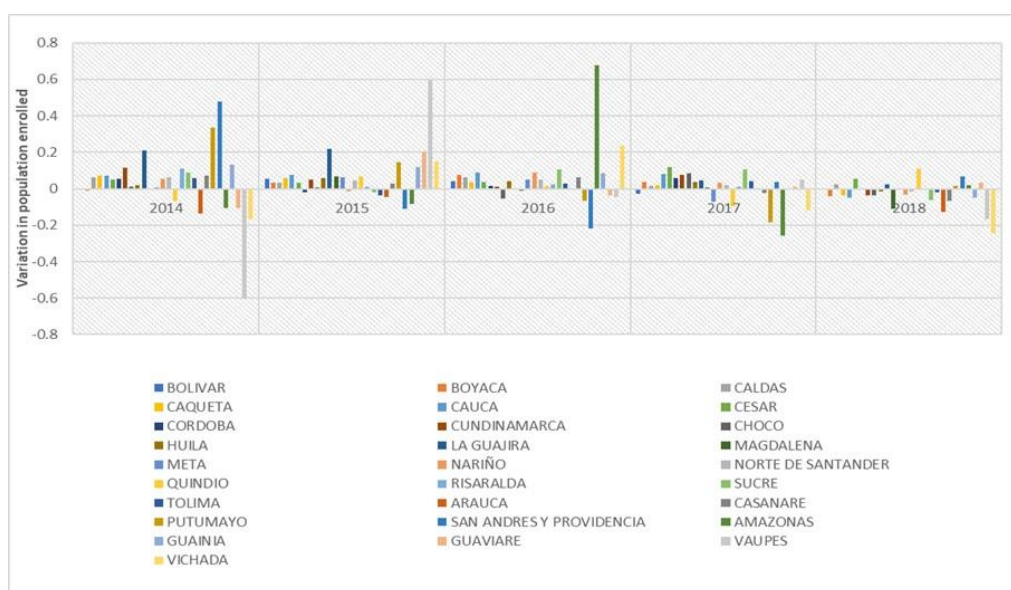
Figure 2. Variation in population enrolled from 2014 to 2018.
Source: Ministry of National Education of Colombia (2018).

Taking into consideration the rate of income from the rural population, the departments with a high concentration of students enrolled differ (Figure 2). The negative trend in terms of student enrolment in the rural departments is evident. In 2018, the department with the highest growth in enrolment was Quindío with 10.85%, while in Vichada it was 24.44%. In general terms, there is a disparity in higher education enrolment in these areas, since there is a negative trend since 2015, going from 6.40% growth in that year to 5.01% in 2016, 0.33% in 2018 and −2.77% in 2019. In

addition, the areas with the lowest number of students enrolled are those with the greatest variation in growth, such as Vaupés, Amazonas, Vichada and San Andrés, Providencia, and Santa Catalina.

Finally, for financing programmes for access to higher education for the rural population, the credit line called Generation E for the year 2019, had accumulated 43,718 beneficiaries in the equity component, of which 86% entered by meeting the requirement of low socio-economic conditions and the remaining 14% belonged to vulnerable populations (ex-combatants and indigenous peoples). However, 33.28 per cent of the total condonable credits allocated to this line were allocated to the population located in the departments and special districts with the highest urbanization index (Ministry of National Education of Colombia, 2020). Although, in the case of the line "Mas Colombiano Que Nunca" (Programme" More Colombian than Ever") there are no statistics on the beneficiaries, but it was recognised that 15 HEIs integrated the group of regionalisation of higher education through programmes in virtual modality, with a portfolio of 95 technical, technological, and professional training programmes (Colombian Institute for the Evaluation of Education, 2019).

Challenges for rural higher education policies

In the context of the COVID-19 pandemic, the World Bank pointed out (2021) "these scarring effects on potential output reflect the pandemic's adverse impact on emerging market and developing economies (EMDE) physical and human capital. Among the most vulnerable countries, the impact of the pandemic will reverse several years of income gains" (p. 3), which is a challenge for educational public policy regarding higher education in rural areas. Even more, student retention requires public policies aimed at access, retention and timely graduation must be based on variable monitoring studies from many different perspectives (Barragán & Gonzalez, 2022) bearing in mind the "high dropout rates among the rural student population, which were catalysed by COVID-19" (Guzman et al., 2021a).

Discussion

In contrast to the studies carried out in the international arena, the present one has shown that education, especially at the higher level, continues to consolidate as one of the ways in which states can overcome the social disparities in rural areas, hence the importance of facilitating access to this population (Hung et al., 2020; Semke & Sheridan, 2012; Byun et al., 2012; Arnold et al., 2005). Taking into consideration what has been stated, public policy in Colombia has focused on eliminating the barriers to access to education based on the low representation of rural students in the system (Perna & Steele, 2011; Ness & Tucker, 2008). This has resulted in the design of varied educational models for this type of population, driven by the development of public policies, which in the case of the country has gone from face-to-face education to flexible educational models based on virtuality.

Although progress in the development of this type of policy is recognized, it was evident, as in the study by Avendaño et al. (2017), that the National Education Plans have been well intentioned in incorporating strategies for rural areas, however, the lack of clear strategies has made it impossible to comply with them, together with the ineffectiveness of some of these strategies such as CERES. In the case of the policies developed since the Peace Agreement signed between the Government of Colombia and the FARC-EP, there has been a prevailing need to articulate at secondary level with higher education, to recognize the previous and ancestral knowledge of rural communities, and finally to explore new alternatives in pedagogical models to overcome the difficulties arising from geography, poverty, drug trafficking and violence in these territories in

Colombia. This type of strategy allows for increased participation of rural students in higher education as argued by Baldwin and James (2010); Perna and Steele (2011); Byun et al. (2012) and Yiu and Yun (2017).

While the use of flexible modalities allows for expanded access, it must be recognized that there is a widespread challenge in the country regarding their use in rural areas, due to the inefficiencies of the higher education system that result in low levels of timely graduation and high levels of dropout, as recognized by the OECD (2018a), and by the Ministry of National Education of Colombia itself, who estimated that it takes students four to six additional academic periods to complete their studies, or, in the case of dropouts, levels in rural populations are high, reaching 50% for undergraduate programs, making it difficult to transfer the economic, social and individual benefits of educational level (Lance, 2011; Montenegro & Patrinos, 2001; Lipset, 1959). In this context, the study carried out by Guzmán and Rodríguez-Cánovas (2020) showed that in the case of desertion in rural areas, not only should access to higher education be encouraged, but also that the strategies generated by the Colombian State should be accompanied by allowing access to information and communication technologies, developing, or strengthening the skills of previous academic levels, and improving the support of teachers and officials of the HEIs, among others.

Now, about to the financing of higher education for rural students, programmes have been consolidated for this purpose, however, the method incorporated in public policies is being questioned since the credits that can be waived require the completion of their training process so that they are not collected, however, the high drop-out rates (50% per cohort) recorded by the Ministry of National Education of Colombia indicate that some of the subsidiaries will have to pay back the resources, which represents an increase in the debt levels of the student and his or her family, leading to an inability to pay and detriment to their financial condition, and even to a worsening of their poverty. Moreno et al. (2019) have also pointed out the disadvantages of the role of credit as a means of financing education in other educational scenarios in Latin America.

On the other hand, regarding the baseline of public policies developed since the Peace Agreement, Colombia must improve the immediate transition from secondary to higher education because the population in secondary education has been characterised by a decline and those who graduate do not enter higher education. In addition, the low levels of skills developed in secondary education make it difficult for the teacher to play an active role in higher education, so joint strategies must be implemented with HEIs to overcome this problem. Therefore, the results presented in this chapter serve as a basis for quantitative analyses of public policy after the implementation of its strategies and mechanisms.

Conclusions

This document makes visible the historical disparity that has existed regarding this level of training in the rural areas of the country, since from the beginning the State did not seek to consolidate a coherent proposal for its incorporation. It was only until the change in the political constitution and the General Education Law that rurality was linked to higher education, materializing in the ten-year education plans. However, its ineffectiveness in these areas was mainly due to the lack of clear strategies for the fulfilment of the objectives. Thus, it was only since the signing of the peace agreement that the establishment of a policy for the level of education centred on these areas began.

Having considered that, formally the rural higher education policy aims to reduce the gap that has existed in the education system, between the urban and the rural. Although the strategies

proposed in this policy are in line with the tradition of the country's higher education policy, which focuses mainly on achieving coverage, other problems affecting these areas have been incorporated into the policy, such as the decrease in student enrolment in secondary education, the low level of skills of students in these areas, the low transition from secondary to higher education, the concentration of educational provision, drop-out, and funding, among others.

Based on the analysis presented in the results and the discussion, the State with the implemented strategies in the PEER and the Rural Plan for Higher Education can achieve: 1) the availability of the service by allowing through the flexible modalities to increase the educational offer in the rural areas and to increase the number of HEIs that provide their services; 2) the adaptability in which the rural students can be provided with special education to their environment, and, that can be adapted to the needs of the learners; 3) acceptability in terms of quality, since students can be enrolled in high quality programmes, which are not naturally present in rural areas due to social disparities there; and 4) accessibility with which financing is provided through credits and write-offs to rural students.

While the definition of this policy is a significant step forward in terms of the development of rural areas, it is important to recognise the many challenges involved, since the state must not only set itself the goal of educating the population but must also prevent migration to the cities and ensure that the benefits of education are realised in rural areas.

Finally, considering the limitations of the study and future lines this study is only descriptive with a highly theoretical component of the analysis of public policies for access to rural higher education in Colombia which can be a study limitation. In this sense, empirical studies which allow a comprehensive evaluation of these policies must be carried out, and therefore the community in general must be invited to address research related to the efficiency of flexible modalities for rural populations, the consequences on learning of the lack of access to technology, the influence of credit as a means of financing higher education in populations in a condition of vulnerability, among others.

Chapter Two: Rural Population And COVID-19: A Model for Assessing the Economic Effects of Drop-Out in Higher Education

The findings in the previous chapter made it clear that the state has presented multiple problems in guaranteeing access to higher education in rural areas, due to the lack of clear strategies to guarantee access to higher education in rural areas. It was only after the signing of the peace agreement that a specialised public policy was established for the rural student population in order to reduce access gaps, however, the high levels of dropout that occur can exacerbate social disparities, particularly when the role of the state is focused on financing access to education with loans. Thus, this chapter modelled the economic effects of dropout for students and their families, for HEIs and for the state, based on the policies of access to education level.

Abstract

Higher education is one of the ways to overcome social inequalities in rural areas in developing countries. This has led states to develop public policies aimed at access, retention, and timely graduation of students in those sectors, yet the high drop-out rates among the rural student population, which were catalysed by COVID-19, prevent the intrinsic and extrinsic benefits of obtaining a higher education degree from materialising. Thus, the study of the phenomenon of dropout before and after the pandemic has not sufficiently addressed the economic issues raised by this phenomenon for the different actors at the educational level. The purpose of this chapter was to model the economic effects of rural student dropout at the higher education level for students and families, Higher Education Institutions (HEIs) and the State, based on public policies for access to higher education, in the pandemic and post-pandemic scenario. To delimit the operationalisation of the proposed model, a set of undergraduate training programmes in Colombia was taken as a reference. System dynamics was used as the main modelling technique. The model was based on data from the 20 training programmes with the highest number of students enrolled in rural areas for the year 2019, by running three computational simulations. The results showed the description of the dynamic model and the financial effects of dropout for the actors of the educational level with the current policies of access to higher education, the scenario in which COVID-19 would not have occurred and the consolidation of the public policy of tuition fee exemption in public HEIs because of the pandemic. It was concluded that the model developed is very useful for the valuation of these economic effects and for decision-making on policies to be implemented, given that the costs of dropout are characterised by high costs for students and their families as well as for HEIs, and where it was determined that current policies are inefficient in preventing and mitigating dropout.

Introduction

Higher education has been conceived to overcome social inequalities in developing countries (Marginson, 2011; OECD, 2017; Herbaut & Geven, 2020; Guzmán et al., 2021b), hence, the interest of the states to intervene through the development of public policies with the aim of facilitating access, permanence, and timely graduation of students at this level of education (Herbaut & Geven, 2020). That said, it is recognised that there are several population groups where social inequalities are more pronounced, especially those located in rural areas. This was confirmed by the United Nations when it stated that by the year 2020, 80% of the world's poor people would live in rural areas, and that in some countries most of the population would be concentrated in rural areas (United Nations, 2021).

In this context, public policies developed by states to facilitate access, retention, and timely graduation of students in rural areas of developing countries, especially in developing countries,

have been based on a paradigm in which the state assumes the role of funder of students (Marginson, 2016; McCowan, 2016). In this way, the State finances tuition under the form of educational credits or tuition fee exemptions, either totally or partially, where in the latter case, it relies on the Higher Education Institutions (HEI), the family or the student him/herself to cover the totality of the expenses.

Although there has been a generalised concern on the part of states regarding access, retention and timely graduation in higher education for rural populations, it is necessary to recognise that the strategies used for financing bring with them multiple effects for the actors at the educational level (student and family, HEI, State, among others), especially when there are high dropout rates in this student population, as exemplified in the Colombian case where the Ministry of National Education of Colombia (2009) indicated that the dropout rate per cohort was close to 50%. Taking into consideration what was previously stated added to the context of the COVID-19 pandemic, it has been identified as a catalyst for problems at the educational level (e.g.: Pokhrel & Chhetri, 2021; Dennis, 2020; Mailizar et al., 2020; Abbasi et al., 2020; Sobaih et al., 2020; Favale et al., 2020; Basilaia & Kvavadze, 2020; Kerres, 2020; Wang et al., 2020), including dropout levels among the most vulnerable populations (Guzmán et al., 2021b; United Nations, 2021), Hence, a critical analysis of the economic effects of this pandemic on education stakeholders related to the drop-out phenomenon is required.

In this sense, both public policy makers and researchers at the higher education level have not analysed in detail, either before or during the pandemic, the financial problems caused by drop-out in rural populations for students and their families, HEIs and the state, within the framework of public policies for financing higher education. This is largely due to the lack of robust models that allow the valuation of the economic effects of dropout, as well as the general interest of the academic community in analysing other aspects of the COVID-19 pandemic for this student population, such as the use of and access to technological resources (Cameron-Standerford et al., 2020).

In this context, the analysis of the economic effects of dropout in the framework of public higher education funding policies, prior to and during COVID-19, has been characterised by being clustered at the national or state level (e.g.: Sahoo et al., 2021; Dennis, 2020; World Bank, 2020; Denning, 2017; Richburg-Hayes et al., 2015; Bettinger, 2015), or, cases of individual studies in an HEI (e.g.: Bernal, 2018; Barragán & Rodríguez, 2015), for which there is not a panorama reflecting the realities of rural students. In addition, the improvements developed are not usually of a holistic nature and integrate the actors at the educational level but are characterised by being individualised for each of the actors (student and family, HEI, or State), especially in the field of modelling (e.g: Cristia & Pulido 2020; Moreno et al., 2019, Sosu & Pheunpha 2019; Hällsten 2017; Fack & Grenet 2015; Rubin 2011; Qu, 2009).

Considering the public policies of access to education, the phenomenon of dropout in rural populations, the effects that COVID-19 has had on the educational level, the fragmentary analysis of the economic effects of dropout and the lack of models that integrate the actors of the educational level, especially in rural populations, the aim of this chapter was to model the economic effects of rural student dropout at the higher education level for students and families, HEIs and the state, based on public policies for access to higher education, in the pandemic and post-pandemic scenario. For the operationalisation of the proposed model, a set of undergraduate training programmes in Colombia was taken as a reference.

The selection of Colombia for the operationalisation of the model is due to the various social disparities experienced in the country, which are directly or indirectly related to the level of education, and which have been catalysed by COVID-19 especially in rural areas, such as: high levels of poverty, low employability, poor accessibility to basic services such as electricity and internet, unequal access to information and communication technologies, among others. This was made evident in the Agronet Report (2020), where in rural areas 44,362 people became newly unemployed and 108,000 unemployed 2 weeks after the declaration of the national health emergency, and the contraction of the economy has affected the rural population, leading to a generalised decrease in food prices and, therefore, in the income of this population.

With the fulfilment of the objective, various contributions are made to the analysis of the problem of drop-out in the rural student population. Firstly, this chapter complements the advances in the understanding of both the economic effects of dropout in the framework of COVID-19 and its modelling, as it concerns all higher education actors; this complementation is based on the methodological contribution in terms of dynamic modelling, adding a holistic perspective to the analysis in relation to rural populations, as well as a more robust model for the understanding of the studied phenomenon. Secondly, this chapter provides feedback to the managers of public policies on the financing of higher education based on credit and tuition fee waivers with the aim of maintaining, modifying, or eliminating them, to mitigate to some extent, the financial consequences of dropout and overcome the social inequalities experienced in rural areas of developing countries. Thirdly, the model makes it easier for direct and indirect users of educational access policies to make informed decisions by recognising the economic effects of dropping out.

This chapter is divided into five sections. The first one was the introductory overview and justification; the second concerns the theoretical framework and proposed model, which presents the conceptualisation of dropout, the documented economic effects on education stakeholders and concludes with the proposed dynamic model; the third concerns the methodology used for the fulfilment of the objective and for the operationalisation of the model through the use of system dynamics; the fourth reports on the design of the model and the results of the computational simulations developed; and the fifth discusses the main findings and incorporates the conclusions.

Theoretical framework and proposed model

Dropout

Student drop-out as an educational phenomenon does not have a single meaning, but rather there are multiple definitions in the literature and public policies. This is a result of the complexity of this phenomenon which involves several levels of analysis as stated by Guzmán et al. (2021a), Guzmán et al. (2021b) and Kehm et al. (2019). In this sense, this variety of conceptualisations allows for a broader understanding of dropout because it links different aspects, variables, representations, models, and effects of dropping out.

Taking into consideration what was previously stated, the meanings can be categorised as theoretical and operational. In the case of the theoretical ones, they obey those provided by the academic community in which the interaction of multiple explanatory variables of the drop-out phenomenon is contemplated, such as the one given in the framework of the ALFA GUIA project in which this phenomenon was defined as "the cessation of the relationship between the student and the training programme leading to the award of a Higher Education degree, before achieving the degree. It is also an event of a complex, multidimensional and systemic nature, which can be understood as cause or effect, failure or reorientation of a training process, choice or obligatory

response, or as an indicator of the quality of the education system" (Proyecto ALFA GUIA DCI-ALA/2010/94, 2013, p. 6); or, as explained by Zuñiga (2006), the student's decision to terminate his or her training process in advance of its completion.

The second category corresponds to the operational meanings developed by public policies, which facilitate the measurement of drop-out at the higher education level, as well as the evaluation and monitoring of some variables. In the Colombian case, this definition is given according to the time in which a student was not linked to the HEI, being considered a deserter if he/she has not legalised enrolment in two consecutive academic periods, and if he/she has not graduated or dropped out (Ministry of National Education of Colombia, 2009). This chapter falls into the latter category, as it facilitates time-dependent counts, allowing the economic effects of the phenomenon to be modelled and assessed.

Recognising drop-out is a multifactorial circumstance and based on the nature of the objective of this chapter, its study is based on an economistic approach which seeks to understand which socio-economic variables influence students' decision to end their education process early, as well as the effects of this decision on higher education stakeholders. In this respect, the preference of various authors for investigating the socio-economic context of the student, the identification and treatment of this type of variable as presented in the studies developed by Rodríguez-Hernández et al. (2020), Palacio Sprockel et al. (2020), Adrogue and García (2018), De Clercq et al. (2017), Erola et al. (2016), among others. This same situation is present in the study of dropout in rural higher education, as evidenced in the works of Cook et al. (2021), Mncube et al. (2021), Guzmán et al. (2021b), Castleman and Meyer (2020), Rueda et al. (2020), Lewine et al. (2019), Muñoz (2013), De Hart and Venter (2013) and Qu (2009).

However, the literature concerning the economic effects of drop-out for higher education stakeholders has not been widely addressed, especially from the perspective of public policies on access, retention, and timely graduation. Thus, Herbaut and Geven (2020) indicated that in recent years this type of financial consequences have received increasing, but still insufficient, attention. Studies have shown that this type of policy has the capacity to reduce the drop-out rate and increase the graduation rate in the medium term, representing a higher level of indebtedness for students and their families, as well as a lower stranded cost for HEIs. However, from the approach of these policies it has also been observed that in the long term they lose the capacity to reduce this rate once the expected result of the implementation of public policies of access to higher education based on credit has been achieved (Mayer et al., 2015). In the case of HEIs, research has quantified the stranded costs of drop-out and the effects they have on their substantive functions (e.g.: Barragán & Rodríguez, 2015). Finally, the economic effects of this phenomenon on states have been linked to its potential to mitigate the improvement in the income of the population (Cristia & Pulido 2020) and its inability to increase productivity (Atchoarena et al., 2005; McMahon, 2010), lacking an analysis of higher education access policies that are implemented for specific educational populations.

Based on this theoretical framework, the economic effects of drop-out on students and their families, HEIs and the state are presented below in the context of public policies on access to higher education.

Economic effects of drop-out on the student and family

Human Capital Theory, consolidated by Becker (1962), suggests that the student and his family are rational actors who base their decision to invest in education on comparing the costs

(e.g.: tuition values, possible sunk costs, etc.) and the monetary benefits (e.g.: wages, rental income, etc.) of higher educational achievement (Marginson, 2019). The student and his or her family will make the decision to continue their education according to the short, medium and long-term economic benefits for them (Marginson, 2019; Didenko, 2015 cited by Gruzina et al., 2021). Thus, they will make a joint decision to enter higher education, comparing the cost of tuition fees at HEIs, the possibilities of financing with their own resources (Qu, 2009) or the possibility of financing with public or private entities (Nizar & Nazir, 2020; Suhendra, 2020). In this way, of the total number of applicants (high school graduates), only those students who have the financial capacity or who perceive some benefit or a better opportunity cost of higher education in the terms expressed in the Human Capital Theory will be admitted (Chen & DesJardins, 2008; Chen & DesJardins, 2010; Özdoğan, 2021).

In other words, it is understood that the more academic periods a student spends in higher education, the greater the investment made, and consequently in the event of the student dropping out, the higher the investment will be if the student decides to interrupt the process due to the influence of individual variables (Arias-Velandia et al., 2018; Behr et al., 2020), socioeconomics (Contreras, 2018; Palacio Sprockel et al., 2020; Schmitt et al., 2020), academics (Guzmán et al., 2020; Heidrich et al., 2018) and institutional variables (Armstrong et al., 2018; Choi & Kim, 2018), as well as the higher the stranded cost will be for the student or the student's family (Larroucau, 2016; Laaser, 2018). In addition, by resorting to credits originating in public policies, the dropout student and his or her family will incur interest payments, which represents an increase in these costs (Moreno et al., 2019). Due to the existence of dropouts, it is expected that the number of students enrolled in HEIs in this cohort will decrease (Barragán & González, 2017). Finally, the lack of timely graduation of students represents a major stranded cost when students drop out of school (OECD, 2017).

However, the literature has shown the impact caused by the COVID-19 pandemic on the graduation rate of rural high school graduates, represented in a lower number of students with this academic level and triggering a social crisis (Chatterji & Li, 2021; United Nations, 2021) as a result of not being able to attend classes and not having access to adequate Information and Communication Technologies to ensure their training process (Expósito & Marsollier, 2020; Mncube et al., 2021). On the other hand, COVID-19 has decreased the rate of access to higher education, due to the high costs that the educational level represents for the student and his family, because of the economic crisis and the social emergency, since they cannot cover the tuition and other costs associated with the educational level either with their own resources or with credits (Potra et al., 2021; United Nations, 2021). In addition, COVID-19 has led to a decrease in student retention in higher education, which implies a higher drop-out rate (Cruz et al., 2020; Alyoussef, 2021; Guzmán et al., 2021b; Delnoij et al., 2021; López-Aguilar & Álvarez-Pérez, 2021; Teuber et al., 2021).

Economic effects of drop-out in HEIs

As in the case of students and their families, drop-out at the higher education level has a direct impact on the finances of HEIs by generating economic instability, especially in those that depend on tuition fees (private and mixed economy HEIs), and in the case of public HEIs, dropping out is seen as a waste of public funds (Choudhary & Hammayun, 2015; Esteban et al., 2017; Becerra et al., 2020).

In this sense, HEIs with a high drop-out rate have high opportunity costs, as they lose out on tuition fees for a few periods not taken (Barragán & Rodríguez, 2015; Améstica-Rivas et al., 2020). Thus, it is presumed that the more academic periods a student attends, the lower the opportunity cost for HEIs will be. The quantification of the opportunity cost to HEIs resulting from dropping out has been of great interest in developing countries in view of the difficulties faced by institutions in ensuring their sustainability, particularly in developing countries. An example of this is the work developed by Bernal (2018) in which this cost was estimated for a Colombian HEI for the period 2011 to 2014, which amounted to 9,430,866,735 pesos (equivalent to USD 2,468,177), or the work developed by Améstica-Rivas et al. (2020) who estimated that the opportunity cost for Chilean HEIs was USD 23,000,000 for those students who had scholarship credits.

In addition to calculating this opportunity cost, the literature recognises that the higher the drop-out rate, the more difficulties HEIs face in the development of their substantive functions (teaching, research and social outreach), since they have fewer resources available for hiring teachers, training them, developing research projects, disseminating their results and managing links with the external sector, among other things (Voelkle & Sander, 2008). Consequently, the opportunity costs of student drop-out have a direct impact on the quality conditions of the programmes, as well as on the reputation of HEIs, leading to a decrease in the access rate to HEIs (Ortiz & Dehon, 2013; Basilaia & Kvavadze, 2020).

In contrast to the stranded cost of untimely graduation for the student and his/her family, for HEIs this becomes an unconsidered income which, although not directly related in the literature, can to some extent reduce the opportunity cost and the difficulties of drop-out in the substantive functions.

Economic effects of drop-out for the state

In the case of the state, the economic effects of drop-out have been addressed in two ways. The first concerns the consequences on the economy in the short, medium and long term, this being the main line, where studies have indicated the loss of income and purchasing power by the student population who drop-out, which results in lower productivity for the State represented in a stagnation or decrease in Gross Domestic Product (Chetty et al., 2020; Hanushek & Woessmann, 2020); and the second, which concerns the monetary quantification of the drop-out in which this chapter is focused.

Thus, in the case of this second stream, previous research recognises that states, when they assume student fees, especially in public HEIs, assume a stranded cost (Choudhary & Hammayun, 2015), as stated by the World Bank (2020) " (…) students who do not graduate on time (or at all) when they receive public funding consume valuable fiscal resources, which in many cases are not recoverable" (p. 14). On the other hand and based on the educational credit policy to facilitate access to higher education, the states that implement it accept the risk of non-payment by students and their families (Moreno et al., 2019), which leads them to accept such a loss of resources, implying a de-financing of state programmes to grant credits (Améstica-Rivas et al., 2020; López-Aguilar & Álvarez-Pérez, 2021).

Proposed Dynamic Model

Based on the economic effects of drop-out for the student and family, HEIs and the state, as described in the preceding sections, a Causal Loop Diagram or dynamic hypothesis was designed (see Figure 3), in which the existing relationships between the variables of the system are synthesised.

High school graduates who are the potential population for admission to higher education undergo the admission process and once accepted by a HEI, may choose to pay their tuition fees by means of a loan or use their own and their family's resources. Hence, two causal loops are formed. The first one (B1), relates students who did not have access to credits, who are affected by a drop-out rate which, being high, will represent a higher number of non-credit dropouts and consequently a lower number of students. The second (B2) represents credit dropouts who, like non-credit students, are affected by a drop-out rate, resulting in an increase in credit dropouts. The higher the drop-out rate in either case, the lower the retention rate and the higher the stranded cost for the student and his/her family. The higher the number of academic periods completed, the higher the stranded cost due to the impact of variables such as the cost of untimely graduation, tuition fees and interest on credits.
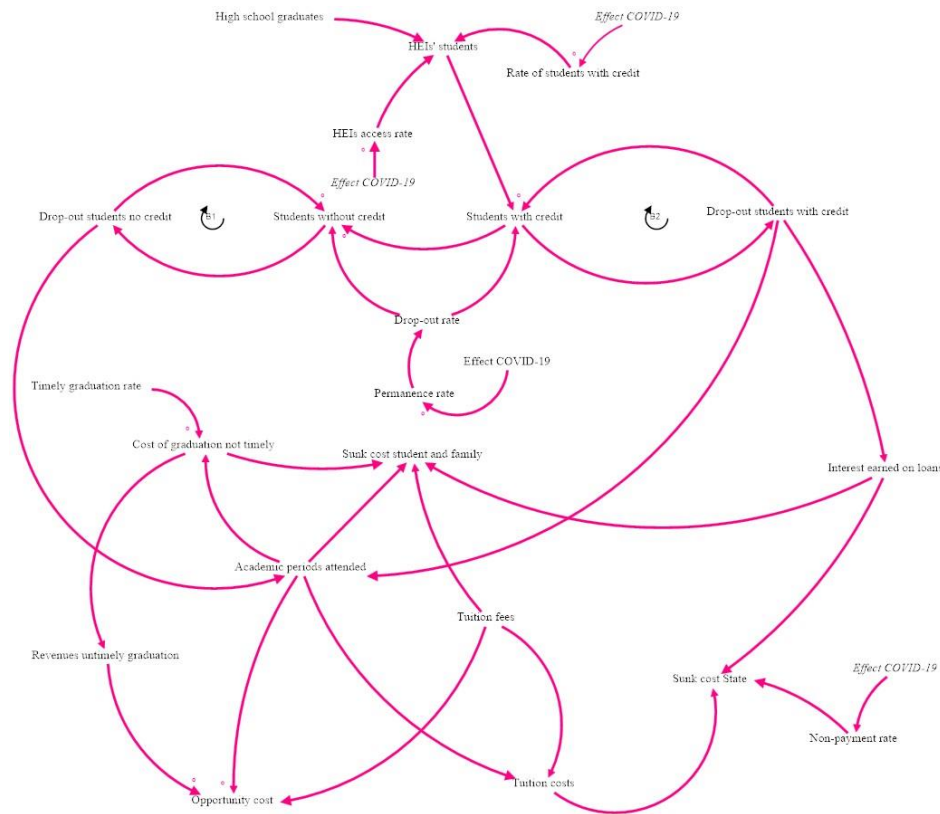
Figure 3. Causal Loop Diagram.
Note: B indicates that it is a balance loop. For the purposes of this diagram, positive relationships have no loadings on the connectors.

As far as the opportunity cost of HEIs is concerned, this is determined by the cost of untimely graduation, given that the higher the number of academic periods taken in addition to those established in the study plan, the lower the cost will be, generating unforeseen income for the HEI, if they are private. In the case of public HEIs, the cost of untimely graduation represents a detriment to the state. On the other hand, the earlier students drop-out, i.e., the earlier they have completed fewer academic terms, the higher the opportunity cost.

In the case of the stranded cost of the state, this will be the result of the value of the tuition fees of students who drop out of public HEIs and the rate of non-payment of credits granted in the

framework of public policies for access to higher education. Finally, COVID-19 influences multiple variables that cause the behaviour of the system to vary, such as the number of new entrants, the survival rate, and the drop-out rate, among others, thus intensifying the economic effects of drop-out on the actors in the higher education system.

Methodology

To fulfil the objective of this chapter, and to operationalise the proposed model (Figure 3), System Dynamics was used as the main modelling and simulation technique. This technique is borrowed from control theory, more specifically, from feedback systems and is distinguished by its ability to deal with nonlinearity, time delay, and multi-loop structures of complex and dynamic systems (Bala et al., 2017). Thus, System Dynamics allows us to analyse the structure of a system, the interactions between its elements and the behaviours derived from these interactions as a function of time (t) (Forrester, 2013).

That said, for the formal construction of the model, the procedure suggested by Bala et al. (2017) was followed, which consists of four stages. The first corresponded to the construction of the flows and levels diagram, understood as the physical structure of the system, in which the levels represent its condition for a defined t, and the flows are the changes resulting from the interaction of multiple variables that modify the initial condition of the system. This diagram, apart from representing the structure, reproduces the system of differential equations, thus achieving the simulation of the dynamic behaviour. The second structured the system of differential equations that represent the cause-effect relationships of the variables. The third established the parameters, assigning numerical values or equations with particular values to the variables of the model. These parameters allow the plausible behaviours of the system to be generated. The fourth, tested the consistency of the model, with the objective of verifying that the results obtained by the simulation of the model represented the behaviour of the system.

In the case of stage three, we used historical data from the National Higher Education Information System (SNIES), the System for the Prevention of Drop-out in Higher Education (SPADIES) and the MEN. In the case of SNIES, information related to undergraduate programmes (technical, technologist and professional) taught in rural areas was extracted, as well as the evolution of first semester enrolments in these programmes and the annual cost of enrolments. In total, the 20 training programmes with the highest number of enrolled students from rural areas for the year 2019 were included, being 25% technical training, 25% technological training and 50% vocational training (see Supplementary 1). From SPADIES, we extracted the number of students per training programme who accessed a credit with Colombian Institute for the Evaluation of Education (2019) in the medium and long-term modality and the survival rate of each of the training programmes; this rate represents the proportion of students in each semester who remain enrolled (Ministry of National Education of Colombia, 2009). Finally, from the studies developed by the MEN, the impact of COVID-19 at the higher education level was determined. The period of observation of the data was from 2015 to 2020, whose history was crucial for the estimation of parameters and validation of the model proposed in this chapter in terms of structure and behaviour.

With the model and data, the model was run to assess the economic effects of rural student drop-out on higher education stakeholders. To this end, the simulations described in Table 1 were carried out.

Table 1.
Computer simulations.

Code	Simulation
SIM-1.	Baseline behaviour of the model with initial parameters.
SIM-2.	System behaviour in the absence of the COVID-19 pandemic.
SIM-3.	Consolidation of the public policy of tuition fee waivers in public HEIs because of the social crisis resulting from COVID-19.

Finally, the computational work on the model and the simulations were implemented in Stella Architect Software version 1.9.5. The following model settings were considered: $t_i = 0$, $t_f =$ 18, $\Delta t = 1$, units of t in academic periods and Euler as the selected integration method. The t_i represented year 2015 first semester and the t_f year 2024 first semester as well.

Results

In accordance with the methodology, the following presents firstly the formal construction of the model, and secondly the results of the simulation scenarios.

Forrester diagram and mathematical model.

Based on the dynamic hypotheses (see Figure 3), the Forrester diagram and the mathematical model were designed considering the flow, level, and auxiliary variables necessary to replicate the drop-out phenomenon (see Supplementary 2). With the design of the diagram and the base model presented below, the corresponding adaptations were made to run the simulations, since the training programmes in the sample have different numbers of academic periods that students must complete to graduate (see Guzmán et al., 2021a; 2021d and 2021e). Thus, the base model was divided into five subsystems.

Subsystem one

The first subsystem corresponded to the behaviour of enrolment, retention, dropout, and graduation of rural students at the higher education level. This starts with first semester enrolment, which is affected by the number of available bachelor graduates in the catchment area of the HEI and the first semester enrolment rate. Subsequently, enrolled students must decide at the end of each academic period whether to continue their education or drop out, and this is repeated until the group of students graduates, thus forming the group of graduates. The equations describing the behaviour of this subsystem are presented below. It should be noted that, for all subsystems, N represents the semester the student is studying in a specific t, and n the number of academic periods to be simulated.

$$B_t = (B_{t-1} + BRG - G)\, dt$$

$$EMN_t = \left[EMN_{t-1} + \left(EMN \times (TSN - ECOVID_D)\right) - \left(EMN \times (TDN + ECOVID_D)\right)\right] dt$$

$$EDN_t = \left[EDN_{t-1} + \left(EMN \times (TDN + ECOVID_D)\right)\right] dt$$

$$G_t = \left[G_{t-1} + (EMN \times TSN)\right] dt$$

$$TD_t = \sum_{t=0}^{n} EDN_t \ dt$$

The previous set of equations operates if the technical condition of non-negativity is found $ECOVID_D$, in other words, $ECOVID_D \geq 0$. For the case of FN and the development of the simulations, 0.01 was taken as the value resulting from the estimates of the Ministry of National Education of Colombia.

$$ECOVID_{Dt} \begin{cases} ECOVID_D = 0 \ dt & if \ ECOVID_D = 0 \\ ECOVID_D - FN \ dt & if \ ECOVID_D > 0 \end{cases}$$

On the other hand, by not considering academic periods prior to the observation period $EM1_t$, This is understood as the academic period in which incoming students join, so this is not defined in terms of EMN_t, but as presented below. It should be noted that, $EM1_t$ is directly affected by the absence or presence of the effect of COVID-19, it should be noted that negative values in the $ECOVID_A$ variables mean that the HEIs increased the number of students when comparing the years 2019 and 2020 so FN adds, otherwise, if positive, they denote a decrease in the number of students, so FN substracts.

$$EM1_t = [EM1_{t-1} + ENI - (EMN \times TSN) - (EMN \times TDN)] \ dt$$

$$ENI_t = \begin{cases} ENI_{t-1} \ dt & if \ ECOVID_A = 0 \\ [ENI_{t-1} - (ENI \times ECOVID_A)] dt & if \ ECOVID_A \neq 0 \end{cases}$$

$$ECOVID_{At} = \left\{ -\left(\frac{\sum EMN_{2020}}{\sum EMN_{2019}} \right) - 1 \right\} \pm FN \ dt$$

Subsystem two

The second sub-system represented the enrolment, retention, dropout, and graduation of rural students in one of the state programmes with respect to the financing of enrolment with educational credits. Recognising that each country has policies, a synthesis of the mathematical model that can be adjusted to different varieties of educational credits is presented, which, in the case of Colombia, are categorised as long and medium term.

$$EMNTC_t = [EMNTC_{t-1} + (EMNTC \times (TSN - ECOVID_D)) - (EMNTC \times (TDN + ECOVID_D))] \ dt$$

$$EDNTC_t = [EDNTC_t + (EMNTC \times (TDN + ECOVID_D))] \ dt$$

$$GTC_t = [GTC_t + (EMNTC \times TSN)] \ dt$$

$$TDTC_t = \sum_{t=0}^{n} EDNTC_t \ dt$$

As long as the provided technical conditions of non-negativity are found, $ECOVID_D \geq 0$.

$$ECOVID_{Dt} \begin{cases} ECOVID_D = 0 \ dt & if \ ECOVID_D = 0 \\ ECOVID_D - FN \ dt & if \ ECOVID_D > 0 \end{cases}$$

Now, for the observation period $EM1TC_t$, as it does not consider previous academic periods and this is the period in which new students join, it has been defined as follows.

$$EM1TC_t = [EM1TC_{t-1} + (EM1TC \times TTC) - (EMN \times TSN) - (EMN \times TDN)] \ dt$$

Subsystem three

The third sub-system describes the economic effects of drop-out for HEIs. It is divided into three sectors. The first sector corresponds to the opportunity cost for HEIs, where the higher the number of dropouts in the first academic terms, whether credit or non-credit students, the higher the opportunity cost. For the quantification of this cost a time lag was used, recognising that once a student drops out, it is in the next academic term that the financial impact will materialise. This is represented in the following set of equations.

$$CON_t = f\ (x_t, x_{t-\tau}, t)\ dt; t \geq t_0$$

$$x =\ CON_{t-1} + (EDN\ \times MATN)$$

$$COT_t = \sum_{t=0}^{n} CON_t\ dt$$

The second sector corresponds to the benefits or additional income resulting from untimely graduation, these are only quantified when part of the student population attends more academic periods than those established by the training programme; for the purposes of this study, only two additional academic periods were considered, although the model is adjustable to as many periods as required. The equations for this sector are described below.

$$BON_t =\ [BON_{t-1} + (EGT\ \times MATN)]\ dt$$

$$BOT_t = \sum_{t=0}^{n} BON_t\ dt$$

The third sector of this subsystem quantifies the financial effects of drop-out for HEIs. In this case C_IES_t takes negative values, it means that for a specific t the unanticipated revenue from untimely graduation was greater than the associated cost of drop-out. This is expressed as follows.

$$C\_IES_t =\ [COT_t - BOT_t]\ dt$$

Subsystem four

The fourth sub-system refers to the financial effects of drop-out for the student and his/her family. This represents the stranded cost which is the result of the cumulative value of tuition fees paid by dropouts, the interest generated by educational credits and the cost of untimely graduation. This is shown in the following set of equations.

$$CHN_t = \begin{cases} [(EDN_t \times MATN) + BON_t + INT_t]\ dt & T\_IES = 0 \\ 0 & T\_IES\ = 1 \end{cases}$$

$$INT_t = [(EDNTC_t \times MATN) \times Ti_t]\ dt$$

$$CHT_t = \sum_{t=0}^{n} CHN_t\ dt$$

Subsystem five

The fifth sub-system represents the financial effects for the state. In this case, a portion of dropouts will not be able to cover the debts of their educational credits, and this portion is likely to increase because of COVID-19. Furthermore, in the case of public HEIs where the state bears the

cost of tuition fees, drop-out represents an additional cost. This is described by the following set of equations.

$$CEN_t = \{[((EDNTC_t \times MATN) + INT_t) \times (Tnp + ECOVID_E)] + (EDN_t \times MATN \times T\_IES) \}dt$$

$$CET_t = \sum_{t=0}^{n} CEN_t \; dt$$

The above set of equations operates, as long as the provided technical conditions of non-negativity for $ECOVID_E \geq 0$, and binary assignment for the case of T_IES_t are found as follows

$$ECOVID_{Et} \begin{cases} ECOVID_E = 0 \; dt & if \; ECOVID_E = 0 \\ ECOVID_E - FN \; dt & if \; ECOVID_E > 0 \end{cases}$$

$$T\_IES_t \begin{cases} T\_IES = 0 \\ T\_IES \; = 1 \end{cases}$$

Operationalisation results of the model and simulations.

With regard to the simulations, in the case of SIM-1, which reflected the reference mode, as for example the behaviour of the system under the initial parameters, it was found that in the case of the technical training programmes from the second semester of 2019, 2019-2 ($t = 9$), and prior to COVID-19, there was a decrease in the number of students enrolled from 496 to 396 students for the period 2020-1($t = 10$) and 330 for 2020-2, according to the developed prospective scenario, the five training programmes in the sample are expected to have 312 students enrolled for the period 2024-1 ($t = 18$). In the case of technological and vocational training programmes, the decrease in students began with the onset of the pandemic. Thus, in the case of the former, 709 students were enrolled at $t = 10$ and 606 were enrolled at $t = 11$; in the case of the latter, 2,720 students were enrolled at $t = 10$ and $t = 11$ 2,650. Now in relation to the prospect, of the number of enrolments for the period 2024-1 for the technological programmes ($n = 5$) it was estimated that there will be 303 students enrolled and for the vocational programmes ($n = 10$) 2,140. Figure 4 shows the enrolment behaviour for the three types of training programmes. In addition, Supplementary 3 shows the enrolment behaviour for each of the academic periods by type of programme.

In terms of student drop-out rates for the technical, technological and vocational training programmes in the sample, before the start of the pandemic there were 747, 330 and 4,250 drop-outs respectively (see Figure 5), as a result of the effect of COVID-19, it was estimated that for the period 2024-1 ($t = 18$), 803 students enrolled in technical training programmes, 1,720 in technological training and 6,450 in vocational training will drop out, which represents an increase in the total number of dropouts of 7.4%, 421.12% and 151%, respectively. In the Supplementary 4 presents the drop-out behaviour for each of the academic periods by type of programme.

However, with regard to the number of students with academic credits who drop out, it is characterised by being low in comparison with the number of total dropouts from the training programmes under study, which can be explained to a large extent by the low rate of access to educational credits by the rural population. In this sense, the simulation for $t = 18$, allowed to establish that for technical training programmes 12.2 ≈ 13 students will have dropped out with educational credits, technological 48.4 ≈ 49 and professional 515.4 ≈ 516. Figure 6 shows the

comparison between the number of dropouts from training programmes and those who accessed an academic credit.

Regarding the economic effects of drop-out for the actors in the education system, the simulation showed that for the five technical training programmes for the period 2019-2 ($t = 9$), it means that before the start of the pandemic, they had a drop-out cost of 494,000,000 Colombian pesos (USD 130,768.37), students and their families had a stranded cost of 694,000,000 Colombian pesos (USD 183,711.03), and the state had a non-payment cost of nearly 69,300,000 Colombian pesos (USD 18,344.63). It was also estimated that by the year 2024-1 ($t = 18$) the total cost of drop-out for the training programmes will be 7,590,000,000,000 Colombian pesos (USD 2,009,173.95), for the family and the student 7,560,000,000,000 Colombian pesos (USD 2,001,232.55), and for the State 1,380,000,000 Colombian pesos (USD 365,304.35).

In the case of the five technological training programmes, the drop-out costs for t=9 were 1,280,000,000 Colombian pesos (USD 338,833.02), for the students and their families 1,600,000,000 pesos (USD 423,541.28), and for the state 128,000,000 Colombian pesos (USD 33,883.30). In turn, for this same type of programme for $t = 18$ it was calculated that the cost of the drop-out phenomenon will be 13,500,000,000 Colombian pesos (USD 3,573,629.55), for students and families 13,600,000,000 Colombian pesos (USD 3,600,100.88), and for the State 2,470,000,000 million Colombian pesos (USD 2,470,000,000 million).

For the ten professional training programmes, the drop-out costs for $t = 9$ were 1,850,000,000,000 pesos (USD 489,719.60), for students and their families 2,750,000,000 Colombian pesos (USD 727,961.58), and for the state 141,000,000 (USD 37,324.58). From the simulation for $t = 18$ it was determined that the drop-out costs will be close to 25,000,000,000,000 Colombian pesos (USD 6,617,832.50) for the professional training programmes, 27,700,000,000 Colombian pesos (USD 7,332,558.41) for the students and their families, and 2,850,000,000 Colombian pesos (USD 754,432.91) for the state. Figure 7 shows the behaviour of the system in terms of economic effects. It should be noted that for the interval from $t = 9$ to $t = 11$ the Colombian state implemented the tuition fee exemption plan in public HEIs (called "*Matricula Cero*"), hence for each type of programme there is an increase in the cost to the state.

SIM-2 assessed the possible economic effects of drop-out in the absence of COVID-19 and changes in the state's higher education access policies; firstly, it was determined that the number of dropouts for the training programmes in the sample would increase, since in the absence of the pandemic there would not be a decrease in enrolments. Thus, for the five technical training programmes, the number of dropouts for $t = 18$ de 1,680; for the five technological training programmes it would be 2,140; and for the ten vocational training programmes it would be 10,900. That stated, in relation to the results obtained in SIM-1, the cost for HEIs would be similar, given that the additional income of HEIs from untimely graduation also increases. Thus, for technical training programmes, for $t = 18$, this cost would be 7,650,000,000 Colombian pesos (USD 2,030,254.78), for technological programmes it would be 13,200,000,000 Colombian pesos (USD 3,503,184.71) and for university training programmes it would be 25,300,000,000 Colombian pesos (USD 6,714,437.37).

On the other hand, in the absence of tuition fee exemption policies in public HEIs, the cost of drop-out should be assumed by the student and his or her family. Given the above for $t = 18$ the stranded cost for students and their families in technical programmes would be 10,000,000,000

Colombian pesos (USD 2,653,927.81), in technological programmes it would be 17,300,000,000 Colombian pesos (USD 4,591,295.12) and in vocational programmes it would be 33,100,000,000 Colombian pesos (USD 8,784,501.06). Figure 8 shows the economic effects for actors at the higher education level.

Finally, in relation to SIM-3, this sought to evaluate the economic effects of the new policies of access to higher education implemented in the framework of COVID-19, which for the Colombian case has included the financing of the academic periods of students in public universities by generating the exemption of tuition fees. Thus, in this simulation for the periods from $t = 13$ to $t = 18$ this free policy was extended. The results of this simulation show that the implementation of such policies changes the stranded cost from the student and his or her family to the state. In this sense, for the case of the technical training programmes in the sample, the cost of drop-out for the State would be 8,590,000,000,000 Colombian pesos (USD 2,279,723.99), in technological training it would be 14,900,000,000 Colombian pesos (USD 3,954,352. 44) and in vocational training it would be 20,700,000,000,000 Colombian pesos (USD 5,493,630.57); for the student and his/her family the stranded cost would be 694,000,000,000 Colombian pesos (USD 184,182.59), 1,660,000,000,000 Colombian pesos (USD 440,552.02) and 10,900,000,000,000 Colombian pesos (USD 2,892,781.32), respectively. Figure 9 shows the results of the simulation in terms of costs for the actors in the education system.

Discussion and conclusion

As presented in the results section, the objective of this chapter was achieved, which was to model the economic effects of rural student drop-out at the higher education level for students and families, HEIs and the state, based on public policies for access to higher education, in the pandemic and post-pandemic scenario. However, it is necessary to recognise that the present study raises a new perspective on the phenomenon of drop-out and COVID-19, which had not been widely explored before this chapter, such as the economic effects for higher education actors, thus complementing previous studies that have analysed this relationship, such as those developed by Teuber et al. (2021), Cruz et al. (2020), Delnoij et al. (2021), Alyoussef (2021) and Cameron-Standerford et al. (2020).

The development of the model for the evaluation of the economic effects of drop-out was based on an integrative vision, distinguishing it from previous models that analysed these effects individually for each actor in the system, such as the works by World Bank, (2020), Bernal (2018), Barragán and Rodríguez (2015). On the other hand, this model makes it possible to link the consequences of COVID-19 on the rates of access to higher education, survival, drop-out and non-payment of educational credits. In addition to the above, the proposed model, based on System Dynamics, made it possible to understand and predict the economic effects of drop-out in terms of time t, brought about by the implementation, modification, and elimination of public policies for access to higher education for the actors at this level of education. Although the chapter focused on rural areas, because of the intrinsic value of education for the development of these areas, especially in developing countries (Herbaut & Geven, 2020; Guzmán et al., 2021a; United Nations, 2021), the model is useful for any student population, HEI or state, as it seeks to represent the behaviour of the education level system.

With regard to the economic effects of drop-out in rural populations, it became evident that prior to the pandemic, in the case of Colombia, and more specifically of the training programmes in the sample, students and their families assumed a considerably high stranded cost, especially

when, on average and according to UNDP statistics (2021), 50% of this population lived in monetary poverty and 27.9% in extreme poverty, with monthly incomes of less than 199,828 pesos (USD 53.17). However, during the pandemic and with the prospective scenarios after the pandemic, the financial relief achieved by public policies of temporary tuition fee waivers is insufficient, given that by 2024 the stranded cost for students and their families is estimated to be higher than the cost assumed by HEIs and the state. In the case of HEIs, COVID-19 has represented an exponential increase in opportunity cost in rural areas. Consequently, the pandemic has the singularity of directly affecting the development of the substantive functions of training programmes, due to the decrease in first-time enrolments and the increase in drop-out rates, which is in line with (Basilaia & Kvavadze, 2020). For the State, prior to the pandemic, the cost incurred was limited to non-payment of loans, however, the student population of the sampled programmes does not typically make use of educational loans so the non-payment rate may be high and not have a major impact on the credit-based student tuition funding programmes.

In the scenario in which COVID-19 had not occurred and affected the level of education in rural areas, the economic effects of drop-out would have intensified for students and their families, as well as for HEIs, because enrolment and its rates would have remained high for training programmes. Finally, for the simulation of the implementation of policies not based on educational credit but on tuition fees, the cost for the student and his or her family would be significantly reduced, as it would be assumed by the state.

Consequently, this chapter highlights the shortcomings of public policies on access to higher education for the rural student population, both in the pandemic and post-pandemic scenarios, as they do not have the capacity to mitigate the drop-out phenomenon, which contrasts with the results of (Mayer et al., 2015). For this reason, it is necessary to continue delving into the reasons why rural students drop-out, since socio-economic variables related to tuition fees do not fully explain the dropping out and high drop-out rates among this student population, and the policies developed by Western countries are insufficient to transmit the intrinsic and extrinsic benefits of the educational level, as stated by Guzmán et al (2021b).

Thus, the limitations of the study, such as the sample size of the training programmes and policies analysed, must be acknowledged. Finally, the academic community is invited to consider the model as a reference, to adjust and adapt it to learn about other economic effects on diverse student populations. On the other hand, decision-makers in the development of public policies for access, retention and timely graduation of higher education students in rural areas are urged to foresee the effects that the simulations presented with the proposed model will have on the different actors at the educational level.
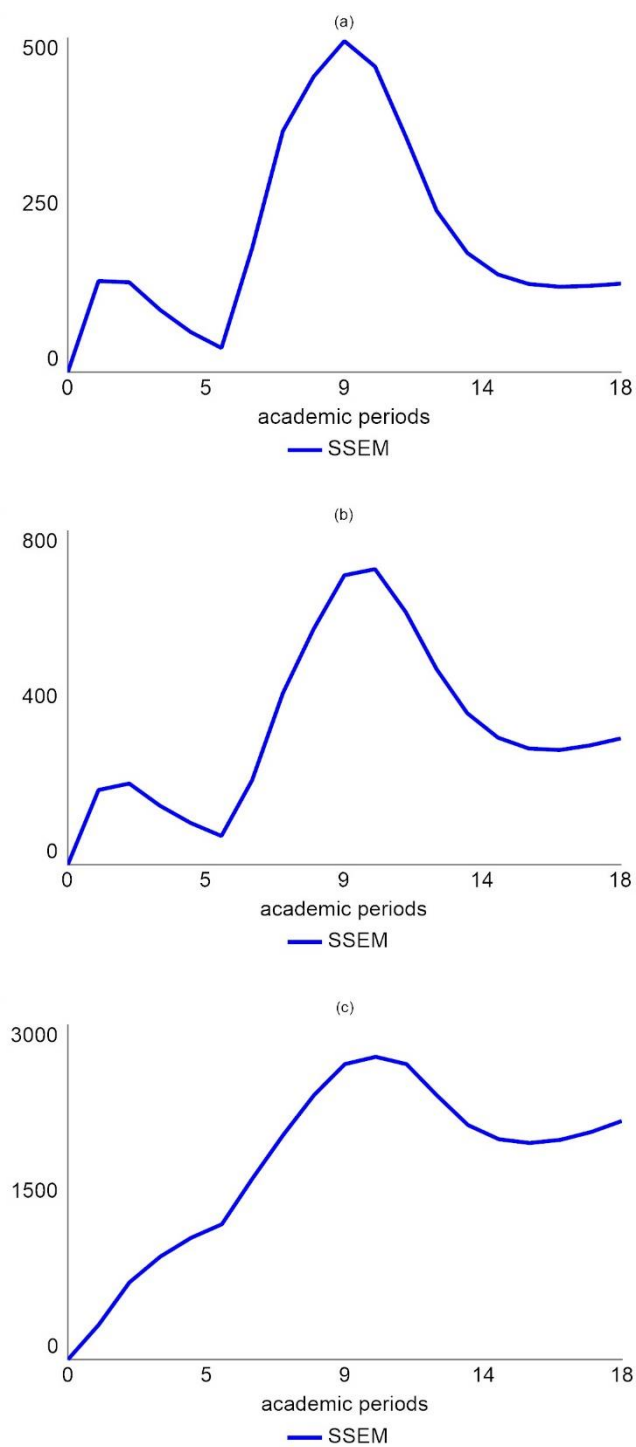
Figure 4. Drop-out behaviour by academic period for SIM-1.
Note: **(a)** presents technical training programmes, **(b)** technology training and **(c)** professional training.
sem: total number of dropouts per academic period.
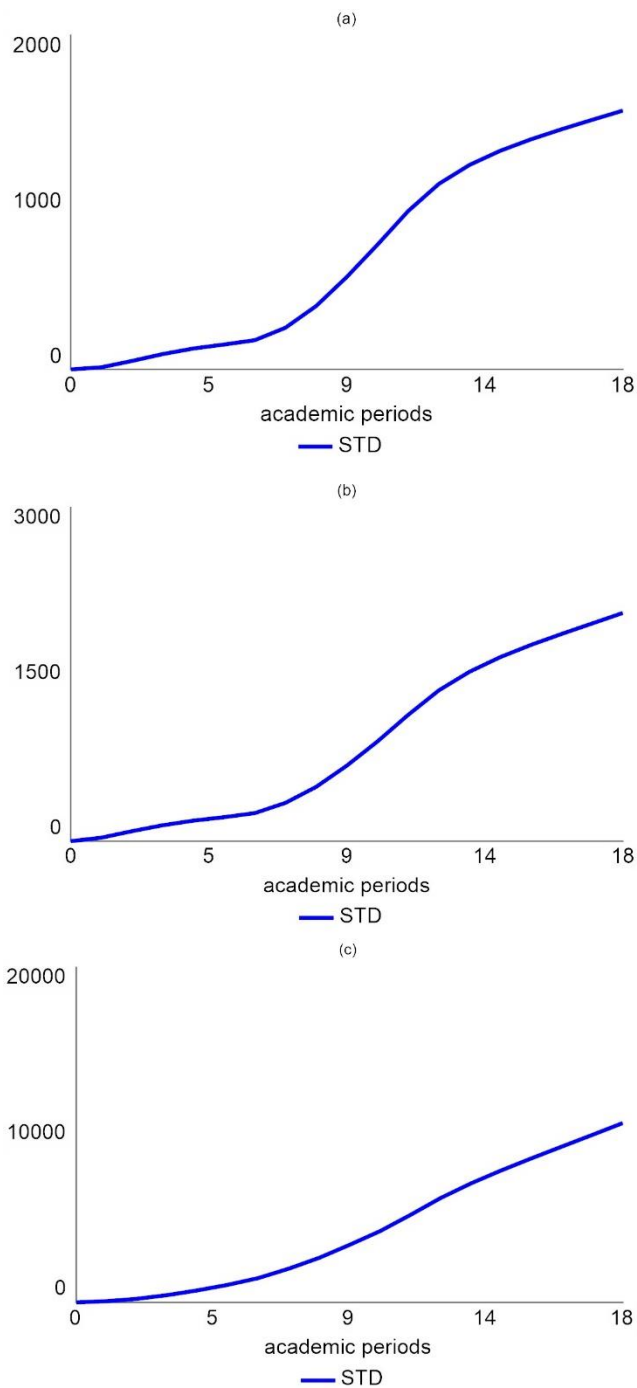
Figure 5. Drop-out behaviour for SIM-1.
Note: (a) presents technical training programmes, (b) technological training and (c) professional training.
STD: Total number of dropouts per t.
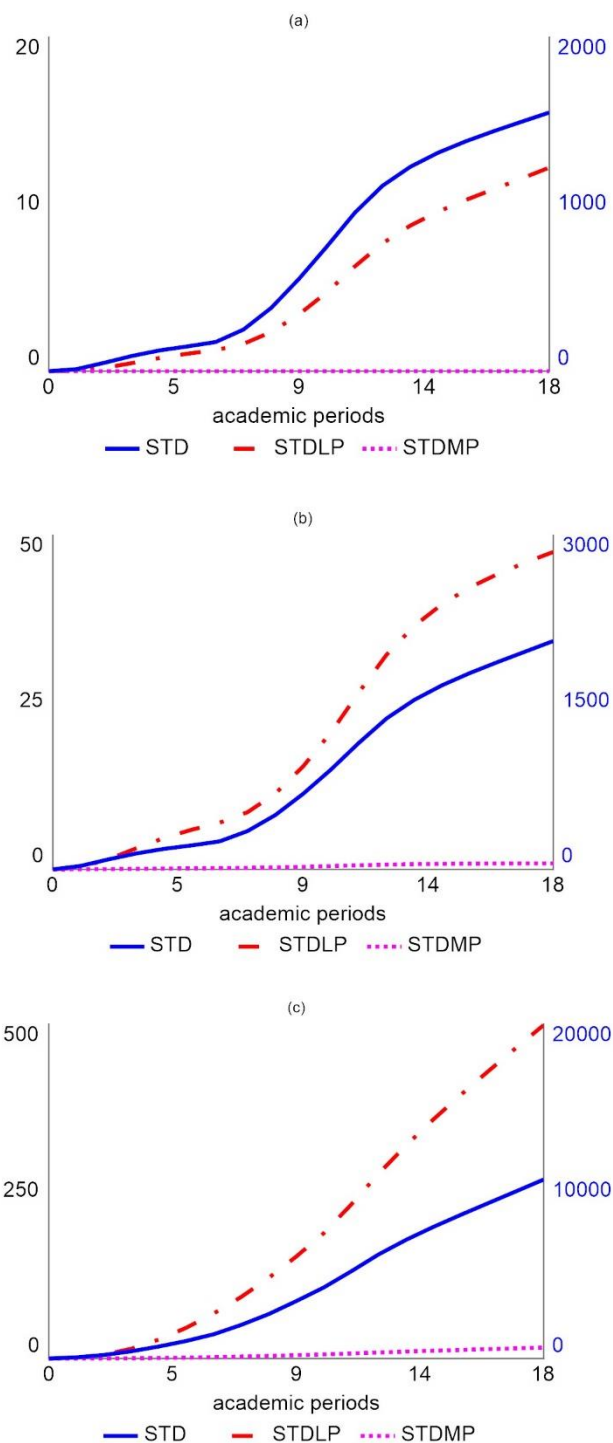
Figure 6. Drop-out behaviour by type of academic credit for SIM-1.
Note: (a) presents technical training programmes, (b) technological training and (c) professional training.
STD: Total number of dropouts per t. STDLP: Total number of dropouts with long-term credits per t.
STDMP: Total number of dropouts with medium-term credits per t.
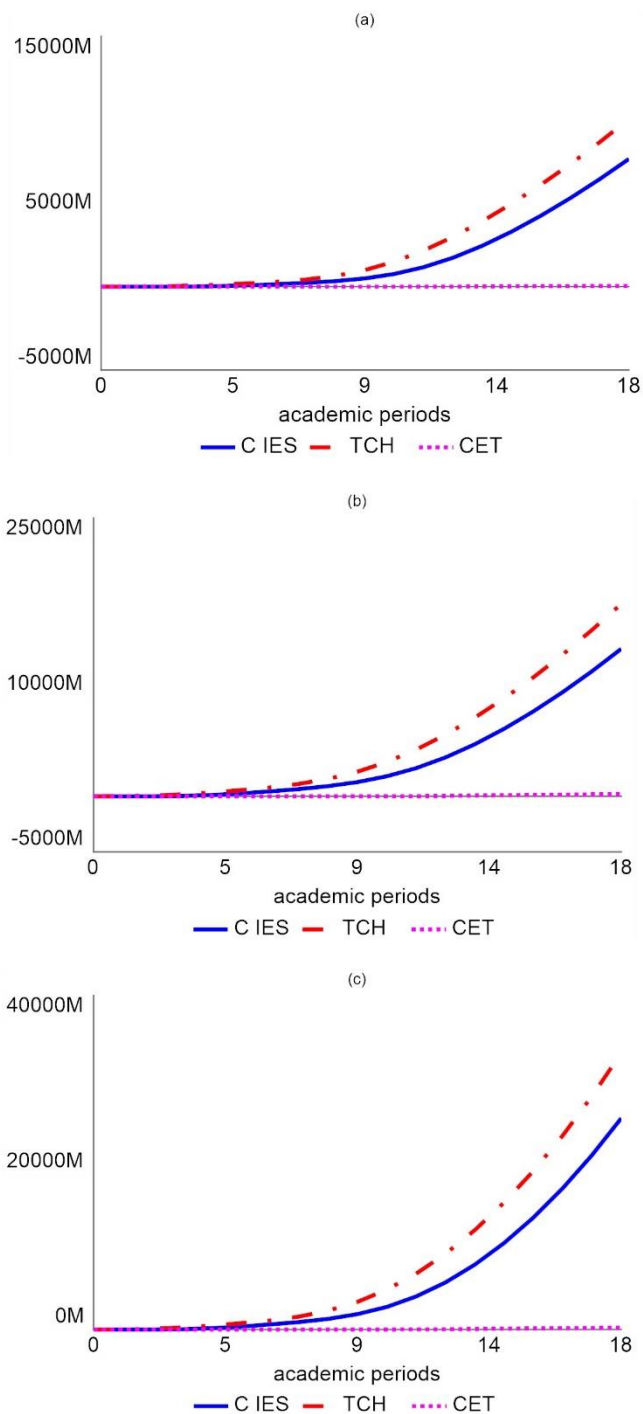
Figure 7. Behaviour of the economic effects of drop-out for SIM-1.
Note: (a) presents technical training programmes, (b) technological training and (c) professional training.
C IES: Total cost for the training programmes under study per t. THC: Stranded cost for the family per t.
CET: Total cost for the State per t.
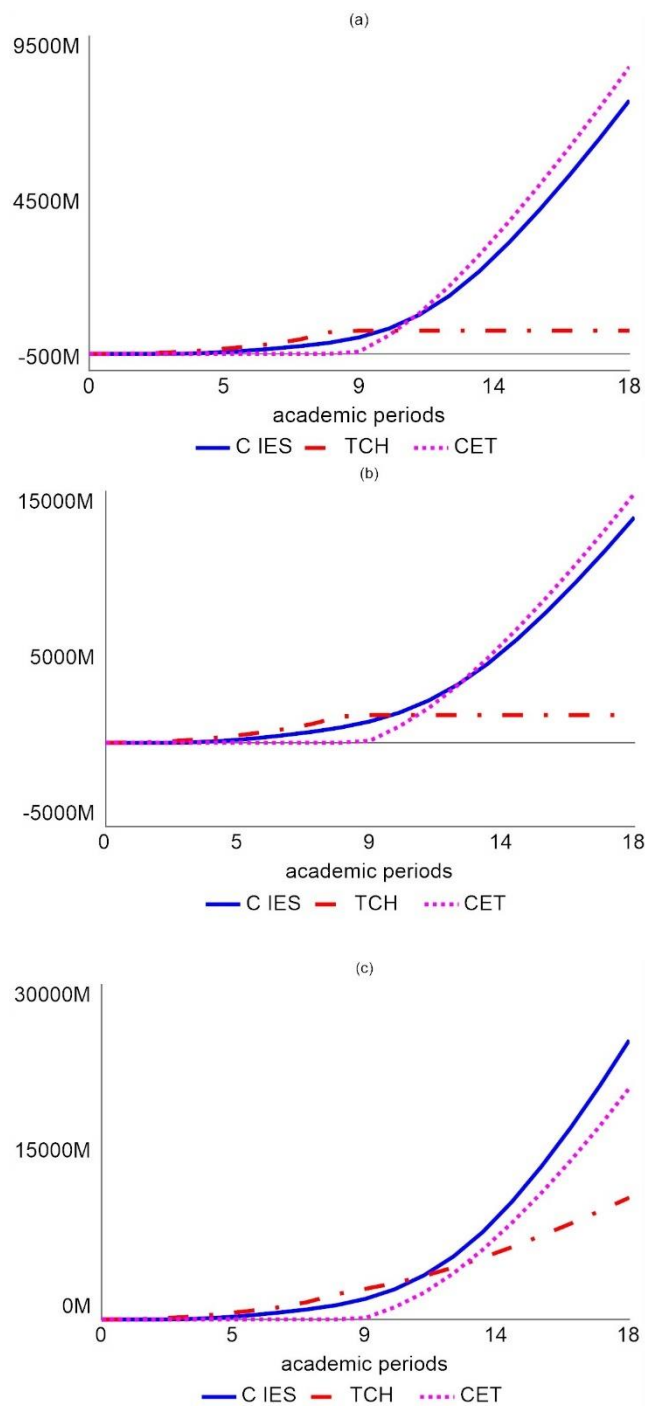
Figure 8. Behaviour of the economic effects of drop-out for SIM-2.
Note: (a) presents technical training programmes, (b) technological training and (c) professional training.
C IES: Total cost for the training programmes under study per t. THC: Stranded cost for the family per t.
CET: Total cost for the State per t.
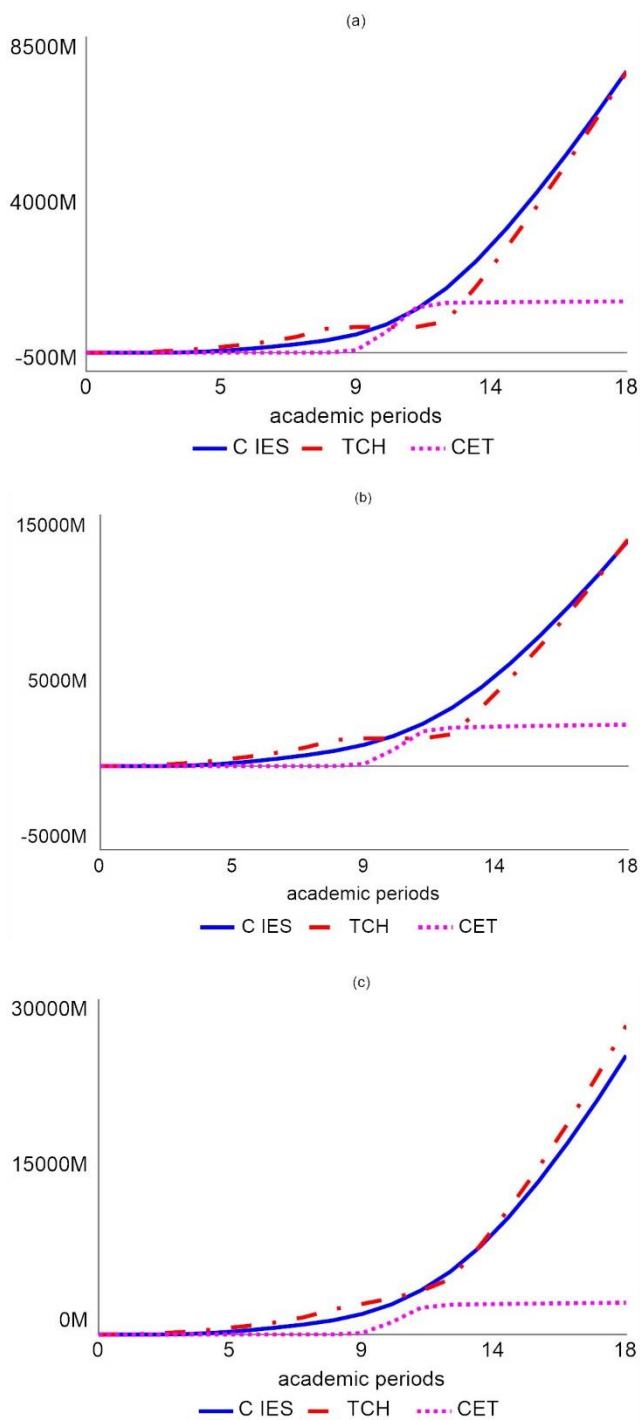
Figure 9. Behaviour of the economic effects of drop-out for SIM-3.
Note: (a) presents technical training programmes, (b) technological training and (c) professional training.
C IES: Total cost for the training programmes under study per t. THC: Stranded cost for the family per t.
CET: Total cost for the State per t.

Supplementary materials
Supplementary 1.
Training programmes used for the implementation of the model.

Type of training programme	Code SNIES	Name of the programme	Operation Department	Type of HEI	Duration of the training programme	Training methodology
Technician	104374	Professional occupational safety and health technician	Norte de Santander	Public	4 academic periods	On-site
Technician	105194	Professional mining operations technician	La Guajira	Public	5 academic periods	On-site
Technician	104635	Port Operations Technician	La Guajira	Public	4 academic periods	On-site
Technician	54993	Professional technician in instrumentation and control of industrial processes	Norte de Santander	Public	4 academic periods	On-site
Technician	103595	Professional technician in industrial safety	La Guajira	Public	4 academic periods	On-site
Technological	52188	Pharmacy regency technology	Norte de Santander	Public	6 academic periods	Distance Learning
Technological	842	Civil works technology	Norte de Santander	Public	6 academic periods	On-site
Technological	104838	Community management technology	Norte de Santander	Public	6 academic periods	On-site
Technological	104946	Civil construction technology	Norte de Santander	Public	7 academic periods	On-site
Technological	53542	Technology in civil works management and construction	Norte de Santander	Public	6 academic periods	On-site

Type of training programme	Code SNIES	Name of the programme	Operation Department	Type of HEI	Duration of the training programme	Training methodology
Professional training	1676	Social work	Chocó	Public	10 academic periods	On-site
Professional training	102322	Public Accountancy	Nariño	Private	9 academic periods	Distance Learning
Professional training	53025	Social work	Chocó	Private	8 academic periods	Distance Learning
Professional training	106333	Bachelor's Degree in Early Childhood Education	Chocó	Public	10 academic periods	On-site
Professional training	102519	Business administration	Nariño	Private	9 academic periods	Distance Learning
Professional training	11835	Public Accountancy	Norte de Santander	Public	10 academic periods	Distance Learning
Professional training	11452	Business administration	Norte de Santander	Public	10 academic periods	Distance Learning
Professional training	52939	Law	Nariño	Private	10 academic periods	On-site
Professional training	5114	Law	Chocó	Public	10 academic periods	On-site
Professional training	13980	Business administration	Norte de Santander	Public	10 academic periods	On-site

Supplementary 2.
Model variables.

Variable	Name	Description
BON_t	Income non-timely graduation	This is the additional income caused by the HEI because of the non-graduation of the student.
BOT_t	Total income from non-timely graduation	This is the sum of the total income from untimely graduation.
B_t	Graduates	Number of students who have completed their secondary education in a period of time t.
C_IES_t	IES financial effects	This is the economic value of the financial stakeholders in HEIs, which is the result of the contrast between BON and BOT.
CEN_t	Financial effects for the State	It corresponds to the economic value not received by the State due to the non-payment of credits, and the loss of resources due to the tuition fees of dropout students which are paid by the State.
CET_t	Total financial effects for the State	It is the sum of the financial effects of the State.
CHN_t	Stranded cost	It corresponds to the economic value assumed by students and families for a period of time. t.
CHT_t	Total stranded cost	It is the sum of the stranded cost.
CON_t	Opportunity cost for HEI	It is the economic value that the university loses because of drop-out in an academic period.
COT_t	Total opportunity cost to HEIs	It corresponds to the sum of the economic value that the university loses because of drop-out in each academic period.
$ECOVID_{At}$	The effects of COVID-19 on access to higher education	It represents the rate of increase or decrease in access to higher education because of COVID-19.
$EDNTC_t$	Dropout students who obtained some form of state credit	Number of students who did not continue with their higher education training programme and who had some form of state educational credit for an academic period.
EDN_t	Dropout students	Number of students who did not continue with their higher education training programme for an academic period.
$EMNTC_t$	Students enrolled in a training programme with some form of state credit	Number of students enrolled in a higher education training programme with some form of state educational credit for an academic period.

Variable	Name	Description
EMN_t	Students enrolled in training programme	Number of students enrolled in a higher education training programme for an academic period.
GTC_t	Undergraduate graduates who obtained some form of state credit	Number of students who completed their training programme, whether technical, technological, or professional, and who had some form of state credit.
G_t	Undergraduate graduates	Number of students who completed their training programme, whether technical, technological, or professional.
INT_t	Interests	The amount of money paid by the debtor for availing the education credit.
$TDTC_t$	Total number of dropouts who obtained some form of state credit	It is the sum of the number of dropouts who obtained some kind of state credit in each academic period.
TD_t	Total dropouts	It is the sum of the number of dropouts in each academic period.
Ti_t	Interest rate	The percentage charged by the lender for the loan of money, in this case education credit.
BRG	Recent graduates	Number of students graduating in a given period $t + 1$
$ECOVID_D$	Effects of COVID-19 on drop-out	It represents the rate of increase in drop-out because of COVID-19.
$ECOVID_E$	Effects of COVID-19 on the non-payment rate	It represents the rate of increase in non-payment of student loans because of COVID-19.
ENI	Incoming students	It is conceived as the number of first incoming students for a given period t.
FN	Standardisation factor	It corresponds to the rate of dissipation of the effects of COVID-19 in the education level system.
$MATN$	Registration	This is the amount that the student must pay each academic period to have access to the educational service.
T_IES	Type of HEI	It establishes whether for the HEI the state covers the concept of student tuition fees.
TDN	Drop-out rate	The percentage of students who do not give continuity to their training process for each academic period. This is represented by the following equation $TDN = 1 - TSN$
TSN	Survival rate	The percentage of students who give continuity to their training process for each academic period.

Variable	Name	Description
TTC	Rate of students accessing credits	The percentage of new students who began their training process with some type of credit. The percentage of students who continue their training process for each academic period.
Tnp	Non-payment rate	The percentage of the student population with academic credits that are not cancelled and are not liable to legal charges.

Supplementary 3.
Enrolment behaviour by academic period for SIM-1.
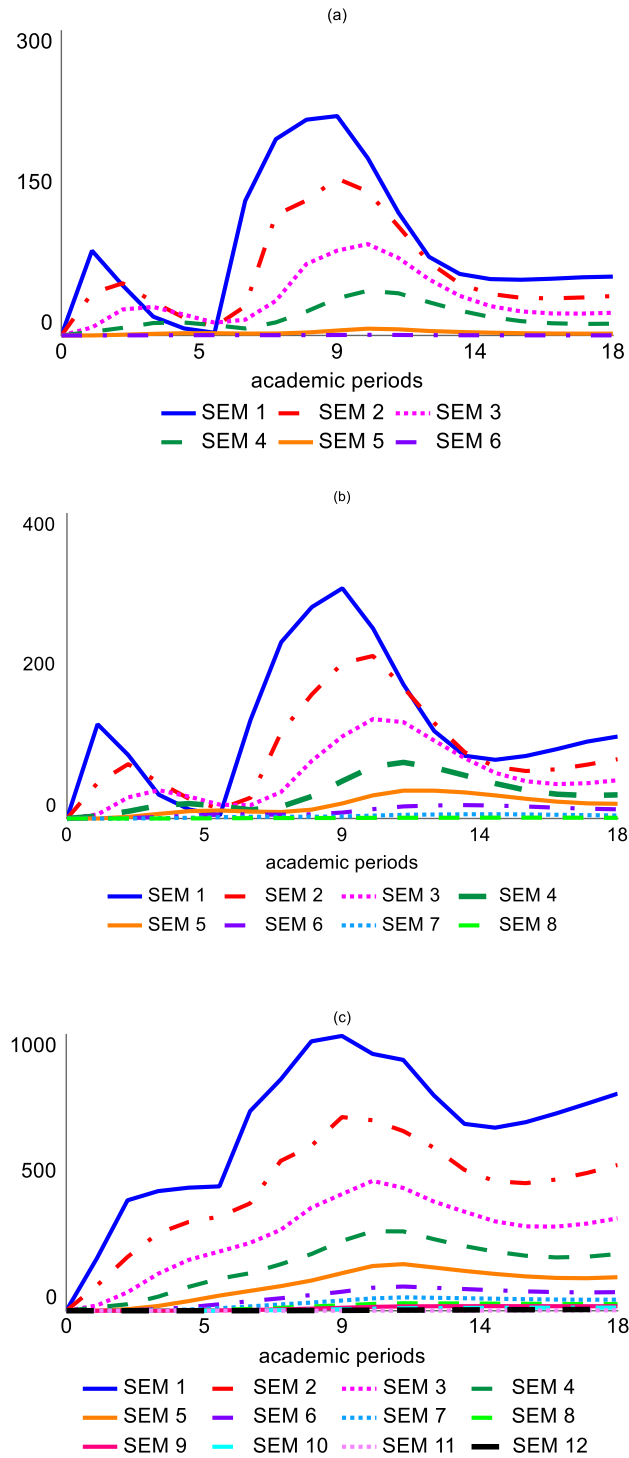
Note: (a) presents technical training programmes, (b) technology training and (c) professional training.
SEM: Total number of enrolments per academic period.

Supplementary 4.

Drop-out behaviour by academic period for SIM-1.
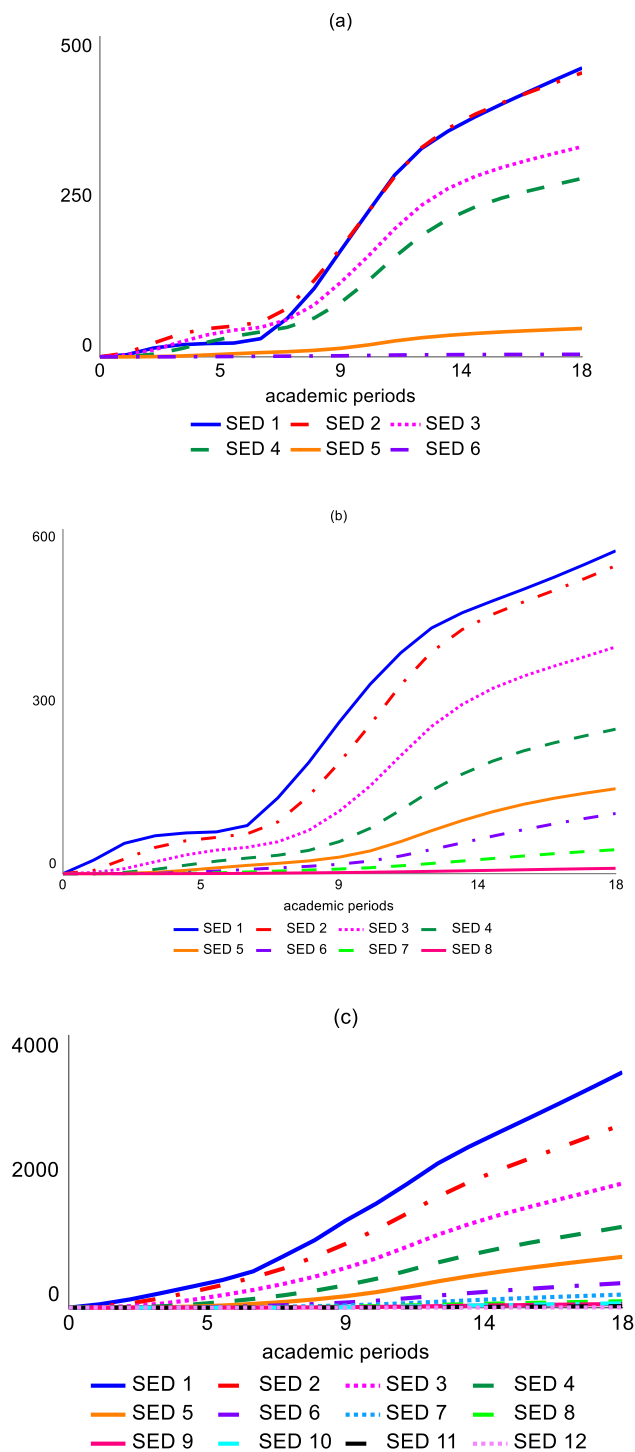
Note: (a) presents technical training programmes, (b) technology training and (c) professional training.
SEM: Total number of dropouts per academic period.

Chapter Three: Dropout in Rural Higher Education: A Systematic Review

With regard to the effects of dropout on the various educational actors, it is evident that this phenomenon has the capacity to increase the various social disparities experienced in rural areas by exacerbating the financial problems of students and their families due to the sunk costs they incur; thus, the prevention and mitigation of this educational phenomenon cannot be limited solely to the provision of financial resources, but must establish which individual, socio-economic, academic and institutional variables influence the materialisation of dropout in the rural student population. As a starting point, this chapter sought to identify these variables based on a systematised review of the literature.

Abstract

Student dropout in higher education has been of great interest to the academic community, state, and social actors over the last three decades, due to the various effects that this event has on the student, the family, higher education institutions, and the state itself. It is recognised that dropout at this level of education is extremely complex due to its multi-causality which is expressed in the existing relationship in its explanatory variables associated with the students, their socioeconomic and academic conditions, as well as the characteristics of the educational institutions. Thus, the aim of this chapter was to identify the individual, socioeconomic, academic, and institutional explanatory variables involved in student dropout in rural populations, based on a synthesis of the evidence available in the SCOPUS database. To achieve it, a mixed systematic review was defined under the PRISMA 2020 method. The analysis was approached in two stages; the first concerned the identification of the documents and the conformation of the sample, where 21 documents were distinguished for effectively dealing with dropout in rural higher education; and the second corresponded to the procedures defined for the development of the bibliometric analysis and synthesis of the information found in the documents. The results showed the distribution of studies by country, years of publication, the categorisation of the documents in SCOPUS, their classification by type and the methodologies used in the development of the studies analysed, as well as the variables that have been addressed in previous research. In this way, it is concluded that the results of the studies are not generalisable, either because of the size of the sample or because of the marked social asymmetries that exist in some countries, which can make the findings lack significance; on the other hand, the interest in research on variables associated with individual and academic determinants to explain rural student dropout is highlighted. In addition, some future research lines which can be addressed as a complement to the current view of the dropout event in rural higher education were identified.

Introduction

In the last three decades, the study of student dropout in higher education has become one of the lines of research of greatest interest for the academic community, state, and social actors due to the high rates of this event, its multi-causality and the effects or consequences it has for the individual, the family, Higher Education Institutions (HEIs), society in general and the state. Considering what has been stated, it is also recognised that dropout rates worldwide have not been controlled and, on the contrary, have increased from an aggregate perspective, being sharpened by the health, economic and social crisis derived from COVID-19, which indicates the ineffectiveness of the actions of governments and HEIs, represented in public policies, the establishment of retention and graduation plans (P&GO for its Spanish acronym) and early warning systems (SAT for its Spanish acronym) (Marquez-Vera et al., 2013; Orellana et al., 2021; UNESCO, 2021). An example of this is the situation in OECD countries where the dropout rate rose from 35% in 2005

to 64.5% in 2018, and in countries such as Luxembourg, Hungary, Sweden, Czech Republic and Slovakia this rate was higher than 70% (OECD, 2018b); or the particular case of Latin America, which has historically had high levels of dropout in higher education, close to 54%, and which are expected to increase as an effect of COVID-19 due to the strong social asymmetries that exist in the region (Becerra et al., 2020; UNESCO, 2020).

Faced with the multi-causality of dropout, efforts have been made to establish the variables that explain current dropout rates and the causes that lead students not to complete their higher education studies, which has resulted in various perspectives and the development of tools that allow decision-makers to have a holistic view of dropout prevention and mitigation (Kehm et al., 2019). That said, research has focused on analysing the influence of specific variables on the materialisation of dropout based on individual student conditions such as age, gender, marital status, family environment, intrinsic motivations and academic self-regulation (e.g.: Ghignoni, 2017; Arias-Velandia et al., 2018; Behr et al., 2020); the student's socioeconomic background exemplified by the socioeconomic stratum of the dwelling he or she lives in, family income, economic dependency and the macro-economic environment of the country (e.g.: Contreras, 2018; Behr et al., 2020; Palacio et al., 2020; Schmitt et al., 2020); the academic factors represented in the development of competencies prior to entry into higher education, secondary school graduation tests, levels of satisfaction in the training programme and the number of courses concurrently taken (e.g.: Guzmán, et al., 2020; Heidrich, 2018); and finally, institutional circumstances in relation to HEI policies, the technological and pedagogical resources provided by the educational institution, the level of interaction with teachers and students and the pedagogical model (e.g.: Armstrong et al., 2018; Choi and Kim, 2018).

On the other hand, the analysis of the multi-causality of dropout has been widely linked to the construction of qualitative, quantitative and mixed models, with the aim of explaining the event in terms of multiple variables; of such studies, the developments made by Spady (1970), Tinto and Cullen (1973), Fishbein and Ajzen (1975), as well as Tinto (1975; 1987), which formed the basis of subsequent studies, and, more recently, Barragán and González (2017), Pérez et al. (2019), Venegas-Muggli (2020), Kilian et al. (2020), Segovia-Garcia and Said-Hung (2021), among others.

However, the consequences of dropout for the actors in the tertiary education subsystem are usually varied. Thus, in the case of students, dropout represents the affectation of learning factors related to emotion, cognition, motivation, among others (Hällsten, 2017), which has long-term repercussions on various difficulties, especially in terms of their work performance (Hällsten, 2017; Sosu & Pheunpha, 2019). For the family, the student's dropout symbolises a sunk cost, due to the expenses were incurred to cover the studies which will never be recovered, (Moreno et al., 2019), as well as the destruction or impossibility of building long-term social capital that allows changing the family's future conditions in both educational and socioeconomic aspects (Ghignoni, 2017). As far as HEIs are concerned, the materialisation of this event means a difficulty in fulfilling their substantive functions (Voelkle & Sander, 2008) by affecting the quality conditions of the training programmes and the reputation of the institutions (Ortiz & Dehon, 2013), as well as impacting the income of HEIs in terms of student enrolments, since dropout represents an opportunity cost that translates into the loss of financial support (Barragán & Rodríguez, 2015).

Finally, in the case of the state, the consequences of dropping out can be categorised as financial and social. In this sense, the materialisation of student dropout represents a damage to the resources made available by the State, since " (...) students who do not graduate on time (or at all)

when they receive public funding consume valuable fiscal resources, which in many cases are not recoverable" (The World Bank, 2017, p. 14); and, on the other hand, dropout prevents the consolidation of the benefits of higher education by making it impossible to improve the average income of the population (Cristia & Pulido, 2020), increase the productivity of the economy (Cristia & Pulido, 2020), consolidate democratic processes (Lance, 2011) and reduce crime (Chalfin & Deza, 2019). In brief, student dropout in higher education can slow down the development and social transformation sought by implementing public policies related to access to higher education, hence the importance of its prevention and mitigation (Guzmán et al., 2021b).

Under the widespread interest of the academic community, state, and social actors in the study of dropout at the higher education level, multiple opportunities have been identified for understanding the event, especially in student groups such as those from or located in rural areas, ethnic minorities and those displaced by armed conflict, which have not been widely studied. This has been evidenced in literature reviews focused on identifying the variables that influence dropout by educational modality, (e.g.: Kara et al., 2019; Guzmán et al., 2020; Orellana et al., 2021), the role of the intrinsic and extrinsic context to the student (Broadbent & Poon, 2015), the methodological approach to the study of dropout (Rodriguez, 2019) and the organisational perspective of the effects of dropout (Fonseca & Garcia, 2016). Based on what has been previously stated, a holistic view of this event in rural higher education is required, due to the efforts made in recent years by states and HEIs to link a population that was marginalised, especially in developing countries, to the educational subsystem and to materialise the direct and indirect benefits of a higher level of education for the population, which are mitigated by the high dropout rates in rural areas. In addition, the lack of such a holistic view makes it difficult for decision-makers to develop effective and efficient public and institutional policies by governments and HEIs to deal with the event of dropout. Thus, the aim of this chapter was to identify the individual, socioeconomic, academic, and institutional explanatory variables involved in student dropout in rural populations, based on a synthesis of the evidence available in the SCOPUS database. Hence, student dropout in rural higher education merits a comprehensive view of the explanatory variables which affect it, to move towards its prevention and mitigation by the various actors in the tertiary education subsystem, especially the State and HEIs (Gibbs, 1998; Byun et al., 2012; Guzmán et al., 2021b; Snyder & Dillow, 2021). To guide the systematised review presented here, the following research questions were proposed:

RQ1: What trends have been followed in the study of student dropout in rural higher education in terms of the characteristics of publications and methodologies?

RQ2: What progress has been made in the study of student dropout in rural higher education, based on the determinants of study (individual, socio-economic, academic, and institutional)?

Accordingly, this chapter is structured in four main sections. The first section describes the conceptualisation of dropout and the theoretical reference model; the second, the methodology used to achieve the objective; the third, the main findings obtained with the implementation of the methodology; and the fourth, the discussions, conclusions, and final considerations.

Dropout and the theoretical reference model
When referring to student dropout, multiple meanings have been developed both by the academic community and by state and social agents, which generates diverse points of view and an enrichment of the discussion around it (Kehm et al., 2019), in other words, these perceptions are not mutually exclusive. As Guzmán et al. (2021b) expressed it, the multiplicity of definitions

derives from specific purposes of analysis, and they have the capacity to complement each other in order to give a broader view of dropping out. In relation with the wide variety of conceptual and operational definitions of this event, this chapter is based on the one given by the Alpha Guidance Project. Thus, drop-out is defined as:

> The cessation of the relationship between the student and the training programme leading to a higher education degree before the degree is achieved. An event of a complex, multidimensional and systemic nature, which can be understood as cause or effect, failure or reorientation of a training process, choice or obligatory response, or as an indicator of the quality of the education system (ALFA GUIA Project DCI-ALA/2010/94, 2013, p. 6).

This definition encompasses both the analysis of specific variables and of the models developed. Consequently, its use allows the theoretical framework of student dropout to be understood from a holistic viewpoint, integrating the perspectives of the academic community, state, and social agents. With this integration of perspectives, the study of dropout has been carried out from a multidisciplinary orientation in which the sociological, interactionist, organisational, psychological and economic approach are highlighted (Lázaro et al., 2020), and have resulted in the analysis of variables intrinsic and extrinsic to the student, categorising them into four determinants: individual, socioeconomic, academic and institutional (Fonseca & García, 2016; Barragán & González, 2017; Donoso & Schiefelbein, 2021; Guzmán et al., 2021b).

Thus, the sociological approach sets the basis for the study of dropout in higher education, assessing the influence of external factors on the student. The contributions made by Spady (1970) explained the event in terms of Durkheim's theory of suicide, in which it is argued that this action is the result of the subject's disconnection from the social system, and therefore, dropout is explained as the lack of social integration of the student into the higher education environment. In addition, this approach considered variables other than social integration in the HEI such as family, expectations and demands that affect the student's academic potential and performance.

Subsequently, the mainstream study of drop-out emerged with its basis on the interactionist and organisational approaches in which this event is explained by the student's academic and social interaction in the HEI. An example of this approach was the model developed by Tinto (1975; 1987) in which the student's emotional and intellectual background was taken as a point of reference, also involving various individual, academic, and family characteristics that directly affect the student's permanence in the HEI. Later mainstream models, such as Bean (1986) or Heublein et al. (2010), incorporated other related variables such as funding opportunities for tuition and other costs associated with the level of education, organisational characteristics of the HEI and student effort, thus providing a broader picture of the drop-out event.

From the psychological perspective, the student's own characteristics and attributes were incorporated, considering aspirations, values, personality, motivation, and expectations of success, so that the individual and his or her variables associated with dropout were observed (Ethington, 1990). This approach has grouped studies that include psychological aspects of the student from the perspective of the educational sciences. Prior to the research carried out by Ethington (1990), the explanatory variables of dropout associated with the student's psyche were not incorporated into the models, which is why the variables categorised in the individual determinant have been incorporated from his analysis. Recent studies have shown the influence of variables such as self-determination (Jeno et al., 2018), personality (Alkan, 2014), introversion (Migali & Zucchelli, 2017) and neuroticism (Migali & Zucchelli, 2017).

Finally, the economic approach has privileged the socioeconomic context of the student and his or her family by evaluating the cost-benefit ratio of staying or dropping out of higher education (Palacio et al., 2020), the influence of family income on the probability of not completing the educational process (Adrogué & García de Fanelli, 2018), social class as a constraint to the creation of social capital (Palacio et al., 2020), among others. While most studies have focused on the student and the family, they have also assessed the impact of the drop-out event on the operational income of HEIs and their financial sustainability (Barragán & Rodríguez, 2015).

Based on this interdisciplinary orientation of the study of dropout and the categorisation of the explanatory variables into the four determinants, this chapter is linked to the conceptual model described in Figure 10, which has been widely used in previous research (e.g.: Barragán & González, 2017; Klein, 2019; Radovan, 2019; Kemper et al., 2020; Vera et al., 2020; Guzmán et al., 2021b) as well as in the development of public policies such as in the Colombian case (Ministry of National Education of Colombia, 2009), because it is adaptive to the educational modality or type of student population, the new realities of the higher education context, as well as allowing the development of explanatory and predictive models of dropout in higher education (Guzmán et al., 2021b).
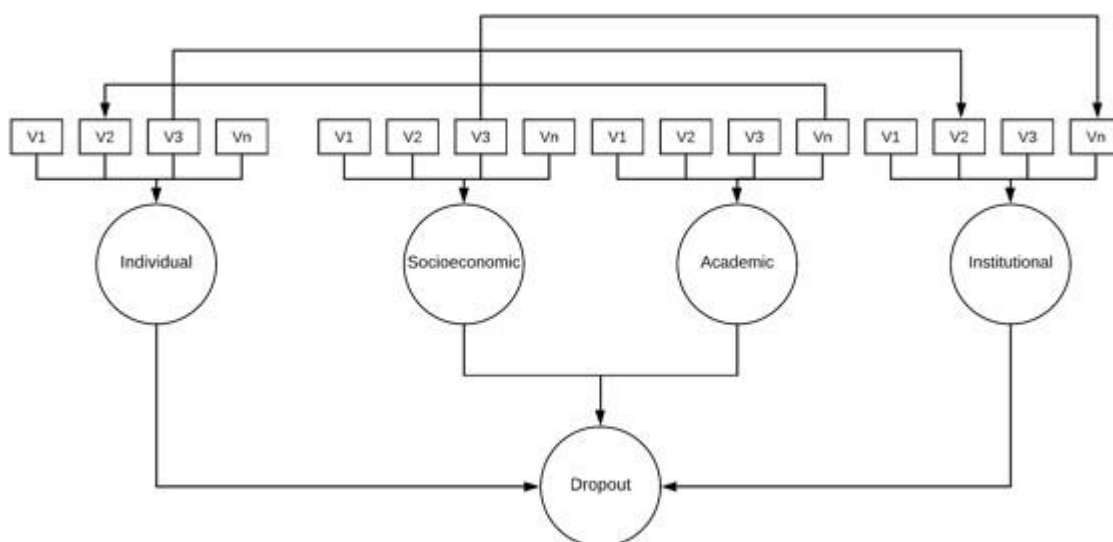
Figure 10. Conceptual model of determinants of dropout.
Note: Each determinant groups n variables $v1, v2, \ldots, vn$ as exemplified in the individual determinant. A variable can have an impact on other variables in the same or a different determinant.

Thus, the determinants are conceptualised as follows:

1. Individual: describes the characteristics associated with the student and his/her personal environment that have a direct influence on the decision to leave the study process unfinished. Examples of the variables related to this determinant are age, gender, marital status, position in the number of siblings, health problems at the time of enrolment at HEI, family environment, fulfilled expectations, family and personal obligations, motivation in relation to the teaching and learning process, self-regulation, and time management.

2. Socioeconomic: this refers to the influence of the social and economic context in which the student is immersed, and which may lead him/her not to complete the higher education process. Among the variables related to this determinant are the stratum, the employment situation, the economic income of the family nucleus and of the student, the economic dependence, and the macroeconomic environment of the country.

3. Academic: these are all those variables related to the teaching and learning process both in previous levels of education and in higher education that may lead students to drop out. Among the variables of this determinant, the following stand out: previous academic performance, courses taken before higher education, secondary school graduation tests, results of admission exams to higher education, teaching qualifications and levels of satisfaction with the academic programme.

4. Institutional: refers to all the characteristics of the HEIs that allow for the correct development of the learning process and others associated with the student, which, if they generate dissatisfaction in the student, may lead him/her not to complete the learning process. Examples of explanatory variables associated with the determinant are institutional policies, funding services, pedagogical resources, the level of interaction between teachers and students, as well as academic support.

Methodology

To carry out the systematic review developed in this chapter, and to achieve the proposed objective, a mixed study was defined under the PRISMA 2020 method. This method was intended for use in reviews that include syntheses of quantitative and qualitative information (Page et al., 2021). Thus, under this approach, two stages were carried out. The first related to the identification of the documents (records); and the second to the analysis and synthesis of the findings.

Stage one: Identification of the documents and sample formation.

In order to identify the literature with the greatest impact on higher education dropout in the rural student population, documents were searched in SCOPUS, which is a curated database of abstracts and citations of scientific documents (e.g.: articles, books and conference proceedings), whose content is generally considered of the highest quality by the academic community, since each of the grouped documents is reviewed by peer reviewers and published under rigorous editorial processes (Schotten et al., 2017). Thus, the equations presented in Table 2 were used to determine the search for the documents. The search was conducted in English, as SCOPUS lists titles, abstracts, and keywords in that language. In addition, other filters were not used in the search for information such as: the period of publication, the geographical area of the study and the quartile of categorisation of the journals determined by SCOPUS. This was not considered relevant because previous empirical research (e.g.: Byun et al., 2012; Guzmán et al., 2021b) highlighted the lack of studies in a generalized manner, for that reason it was sought to include as many studies as possible with the purpose of avoiding the loss of information. In addition, the search for documents was limited to articles, books, book chapters and conference proceedings. On the other hand, for the selection of search keywords, reference to those used in previous systematic literature reviews was made such as Orellana et al. (2021), Guzmán et al. (2020), Rodriguez (2019) and Kara et al. (2019), as well as recent empirical studies such as Guzmán et al. (2021b), Behr et al. (2020), Kehm et al. (2019), Barragán and González (2017), as well as Vera et al. (2020).

Table 2.
Ratio of records found by search equation.

Search equation.	Total number of records found.
TITLE-ABS-KEY (Rural AND bachelor AND dropout)	3
TITLE-ABS-KEY (Rural AND bachelor AND dropout rate)	2
TITLE-ABS-KEY (Rural AND bachelor AND drop-out)	1
TITLE-ABS-KEY (Rural AND bachelor AND "persistence")	1
TITLE-ABS-KEY (Rural AND "Higher Education" AND dropout rate)	3
TITLE-ABS-KEY (Rural AND "Higher Education" AND dropout)	12
TITLE-ABS-KEY (Rural AND "Higher Education" AND Drop-out)	5
TITLE-ABS-KEY (Rural AND "Higher Education" AND persistence)	17
TITLE-ABS-KEY (Rural AND "Tertiary Education" AND dropout rate)	1
TITLE-ABS-KEY (Rural AND "Tertiary Education" AND dropout)	4
TITLE-ABS-KEY (Rural AND undergraduate AND dropout)	4
TITLE-ABS-KEY (Rural AND undergraduate AND drop-out)	1
TITLE-ABS-KEY (Rural AND undergraduate AND persistence)	3
TITLE-ABS-KEY (Rural AND university AND dropout rate)	26
TITLE-ABS-KEY (Rural AND university AND dropout)	66
TITLE-ABS-KEY (Rural AND university AND drop-out)	26
TITLE-ABS-KEY (Rural AND university AND "dropping out")	8

Note: The information search was conducted on 25th March 2021.

As a result of the SCOPUS search, a total of 183 documents possibly related to the event of dropout in rural higher education were detected, which were registered in a database composed of the following data: type of document, year, authors, title of the document, journal, name of the book or conference proceedings, quartile of citation classification (only applied to journals), ISSN or ISBN, and keywords. From the documents found, a total of 69 were eliminated because they were duplicate records. Thus, with the remaining 114 records, the titles, abstracts, and keywords were read, with the intention of purging those documents not related to the topic of study, consolidating

the documentary analysis sample consisting of 17 articles, one book chapter resulting from research and three conference proceedings. It is important to highlight that in the screening phase, and in order to eliminate bias in the selection of the documents, an independent review was carried out by each of the authors, evaluating the full text in the case of those documents in which the concepts were not unanimous. In addition, the PRISMA 2020 checklist was completed for each of the documents. Figure 11 shows the flow diagram of the PRISMA 2020 method.

Stage two: analysis and synthesis.

This stage sought to analyse and synthesise the findings to fulfil the objective of this article. In this way, two phases were carried out: the first was related to the bibliometric analysis of the documents included for review using descriptive statistics and data visualisation in accordance with the parameters established by Nightingale (2009). This phase sought to respond to RQ1. In this way, the country of origin in which the research was carried out, the frequency of publication per year, the categorisation of the articles according to SCOPUS ranking, methodologies used in the development of the studies, among others, were determined. The second phase corresponded to the content analysis of the documents, which answered RQ2, in which the explanatory variables of dropout in rural higher education were sought and associated with each of the determinants of the model described in Figure 10. Thus, each of the sample documents was loaded into the Atlas. ti software and the open coding technique was carried out, as it allows the researcher to establish categories or variables from the reading of the documents, so it is not limited to a pre-established theoretical framework, which results in the possibility of providing answers to questions of a general nature (Flick, 2012). After coding the variables, the findings were synthesised using an inductive approach.

Results

Bibliometric analysis

The review of the sample of papers showed that research had been carried out in ten countries of origin. Thus, seven papers related to rural people in higher education were published in the United States, two in Finland, two in Australia, and, in the case of Bangladesh, Brazil, China, Colombia, Ecuador, Norway and South Africa, one publication each. On the other hand, three of the papers in the sample did not specify the countries in which the research took place.

However, regarding the distribution of the sample by year of publication, no trend was evident, although it was observed that after 2010 the academic community's interest in the study of the event of dropout in the population under study at the higher level has grown, accounting for 52.38% of the documents analysed since that year (see

Table 3 and Supplementary 10).

In relation to the 19 published articles that are susceptible to categorisation by the SCOPUS indicators, only 18 of the sample had such categorisation. Of the categorised articles, 6.25% were in quartile one, 43.75% in quartile two, 31.25% in quartile three and 18.75% in quartile four.

Table 3 summarises the papers in the sample, showing that by journal or conference there is no preference in the publication of research related to rural dropout at higher education level.
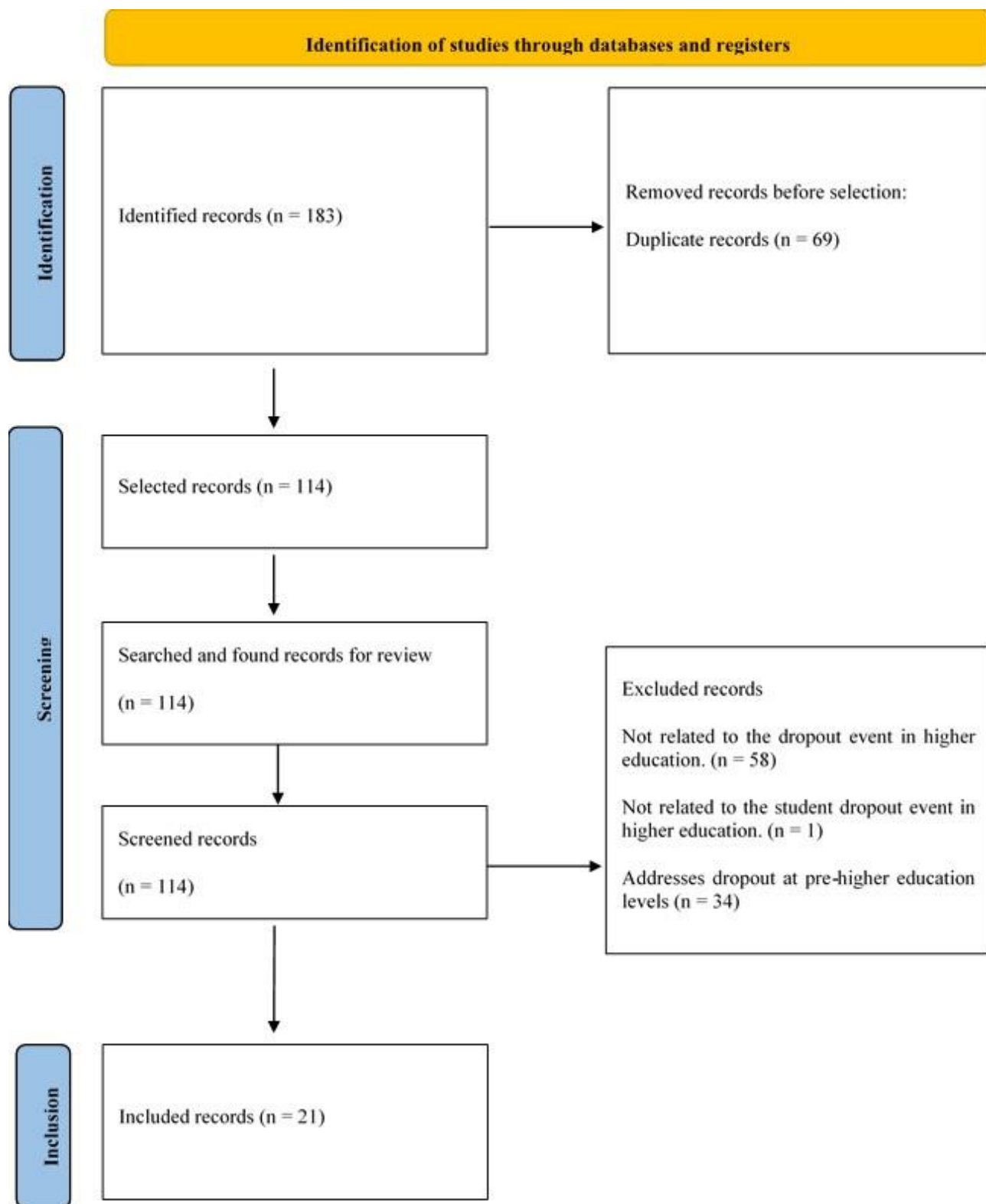
Figure 11. PRISMA 2020 method flow chart.
Adapted from Page et al. (2020).

Table 3.
Documents in the sample under analysis.

Code	Authors and year of publication	Journal, book or conference title	Quartile
A1	Bania and Kvernmo (2016)	International Journal of Circumpolar Health	Q2
A2	Troester-Trate (2020)	Community College Journal of Research and Practice	Q2
A3	Castleman and Meyer (2020)	Review of Higher Education	Q1
A4	Gildehaus et al. (2019)	Innovative Higher Education	Q2
A5	Hines et al. (2015)	Journal for Multicultural Education	Q4
A6	Muñoz (2013)	Journal of Student Affairs Research and Practice	Q4
A7	Rapley et al. (2008)	Nurse Education Today	Q2
A8	Rueda et al. (2020)	Revista de Psicología (Perú)	Q4
A9	Nishat et al. (2020)	Journal of Applied Research in Higher Education	Q2
A10	Pérez et al. (2019)	Educación Médica	Q3
A11	Lewine et al. (2019)	Journal of College Student Retention: Research	Q2
A12	De Hart & Venter (2013)	Perspectives in Education	Q3
A13	Faizullina et al. (2013)	Medicina (Lithuania)	Q3
A14	Rashid & Sarker (2008)	Turkish Online Journal of Distance Education,	Q3
A15	Pillay & Ngcobo. (2010)	South African Journal of Psychology	Q3
A16	Wheat et al. (2003)	Journal of Rural Health	Q2
A17	Warner (1993)	Distance Education	NA
C1	Oliveira et al. (2018)	Researcher Links Workshop: Higher Education for All	NA
P1	Qu (2009)	Proceedings of the International Symposium on Test and Measurement	NA
P2	Meisalo et al. (2003)	Frontiers in Education Conference	NA
P3	Meisalo et al. (2002)	Frontiers in Education Conference	NA

Note: code A refers to articles, C to chapters of books, P to conferences proceedings and NA to not applicable.

About the methodological approach used in previous research, it was found that 71.41% of the studies were characterised by a quantitative approach, 14.29% by a qualitative approach and 14.3% by a mixed approach. Thus, the quantitative studies, and as presented in Supplementary 6 there is a tendency to use the survey as the main data collection technique. In the case of qualitative studies, data collection techniques focus on interviews (in-depth or semi-structured), focal groups and workshops, and finally, in mixed studies, both surveys, in-depth interviews and focal groups are used. Regarding the sample size, most of the studies are characterised by being relatively small in comparison to the country's population, and more specifically, those students linked to higher education in rural areas. Thus, only 29% of the studies had samples larger than 1,000 students, 62% had samples smaller than 1,000 students and 10%, being academic experiences, did not reflect a sample in their methodological section.

Variables influencing rural student dropout in higher education.

Corresponding to the model described in Figure 10, the results of previous research by determinant are presented below. In this sense, a total of 59 variables that have been the object of study were coded. Supplementary 7 presents the explanatory variables found in each of the documents. According to Supplementary 7, 35% of the explanatory variables studied for dropout in rural higher education corresponded to the individual determinant, 27% to the academic, 25% to the socio-economic and 13% to the individual. Thus, in the case of the most studied variables of dropout in rural higher education in the studies analysed, they correspond to 1. the P&GO programmes, this variable has been analysed in 10 case studies; 2. Previous academic experience, being addressed in eight case studies; 3. the state support, the family income and the labour obligations, each of these was analysed in five case studies.

However, the explanatory variables that were only identified once in the documents studied, were: adaptation to the HEI, self-learning, communication, course contents, family dysfunction, ethnicity, lack of job opportunities, academic failure, absences from classes, dissatisfaction with the programme, slow academic progress, Learning Management System, personal goals, fear of failure, motivation, death of relatives, parents' educational level, poverty, nutrition problems, scheduling problems, relationship problems with parents, racism, knowledge recognition, transfer to another university and use of ICTs.

Individual determinant.

With regards to the gender variable, it is evident in the documents analysed that rural women are more likely to drop out of higher education, a situation that has been constant over time, as evidenced by Meisalo et al. (2002) in a population of students in virtual programmes, as well as (De Hart and Venter, 2013) in face-to-face education. The latter authors emphasise that gender is a good predictor of rural students' intention to drop out of higher education because women tend to be more vulnerable as a result of housework and raising children, while men who drop out tend to do so because of work obligations or because they receive material in a second language, the last variable was analysed in the rural South African population, which is characterised by a large linguistic variety.

In relation to personal obligations represented in domestic and household chores, unemployed adults tend to drop out due to the need to provide basic goods and services to their houses, leading them to limit their spending to cover these needs, reducing or eliminating investments in education, so that if the chief member of the family or any of his relatives is the one who studies, he has to drop out, due to the economic insecurity that exists in rural areas (Nishat et al., 2020; De Hart and Venter, 2013). In the case of the work obligations of rural students, research generally agrees that the hours allocated to work compete with study hours. This was reflected by Pérez et al. (2019) when analysing the causes of desertion of a group of rural nursing students, where the greatest number of absences were due to work-related causes, affecting the academic average and influencing the student's decision to abandon their academic process. The same situation is described by (De Hart and Venter, 2013) in rural students employed in the finance sector. On the other hand, it has been established that having partial work obligations such as part-time or service jobs are related to sources of stress for the student as they do not secure sufficient resources to cover their educational and personal expenses, leading them to prioritise seeking full-time employment and sacrificing their professional career (Pillay and Ngcobo, 2010).

In terms of age, research has indicated that both younger and older students located in or coming from rural areas are at risk of dropping out, however, the causes are different. In this regard, Pillay and Ngcobo (2010) identified that arguments and conflicts with and between parents led to young students not completing their academic process. On the other hand, (De Hart and Venter, 2013), established that, in developing countries, young students were the first generation to enter HEIs, so that support structures such as parents, close social references and HEIs' own support structures such as SATs and P&GOs could fail to effectively address the counselling needs of those students. In the case of older students, it was observed that the main reason for dropping out of education was due to work and personal obligations (De Hart and Venter, 2013; Pillay and Ngcobo, 2010).

Following with the support structures, especially with parents, it became clear that the educational level of the parents is significantly related to the student's intention to continue their educational process. Bania and Kvernmo (2016) found that for rural women a higher level of parental education had an influence on the completion of pre-higher education, while for men the level of parental education was related to the completion of higher education. However, the same study argues that the educational level of parents does not have an impact on the completion of higher education among young students.

Another variable related to rural dropout in higher education is the ethnicity or social group to which the student belongs. In this sense, the language in which the study material is designed has a direct impact on the continuity of the academic process, as argued by (De Hart and Venter, 2013) in identifying this case in the Nguni community in South Africa, where unfamiliarity with the learner's culture is propitious to the materialisation of the event. Another phenomenon related to this variable is the racism that students from social groups that have historically been considered minorities may suffer at the educational level, as is the case of Afro-descendants in the United States or illegal immigrants, in which social pressure can lead to a process of demotivation and end up in desertion (Muñoz, 2013; Hines et al., 2015).

Regarding health as an explanatory variable of dropout, studies have focused on the psychological aspects of the student, finding that rural youth with behavioural problems tend to limit the number of years of study they take, which leads them to drop out of the education system or to choose less demanding training programmes, in which the risk of dropping out is greater for students who do not have behavioural problems (Bania and Kvernmo, 2016). In this scenario, it should be recognised that male rural students with particular mental health conditions are more likely to fail to complete their training programme; this is related to the lack of search for HEI support structures (Bania and Kvernmo, 2016). In addition to what has been stated, Hines et al. (2015) found in their research that student mental health affects academic and social processes, being a determinant of non-completion of their studies.

What is more, it has been documented that rural students have a variety of difficulties in adapting to HEIs (Castleman and Meyer 2020). This is due to the change of educational environment involving commuting, creation of new personal relationships, conflict with the size of the educational institution and new academic demands, thus leading, in the words of Castleman and Meyer (2020), to a "shock" that may end in student dropout. This was exemplified in the study by Rueda et al. (2020) in which they segmented rural students who dropped out of a Colombian university, and who had in common the lack of adaptation to the HEI as the main reason for the materialisation of the desertion event.

Regarding other variables, Rueda et al. (2020) identified that the type of family can influence the non-continuation of the educational process. Students with single-parent or extended nuclear families (parents, siblings, grandparents and aunts and uncles who live together in the same house) have a greater risk of not concluding their educational process, as explained in the case of those students with work and personal obligations (Nishat et al., 2020) and in the case of the latter to sources of pressure and stress derived from the family environment (Pillay and Ngcobo, 2010). The death of family members or close relatives as an explanatory variable of dropout is related as a source of stress which, in conjunction with other psychological problems of the student, leads him/her to not complete the training process (Pillay and Ngcobo, 2010).

In relation to individual student variables related to the learning process, Meisalo et al. (2002) found an inversely proportional relationship between rural students' dropout and their attitude towards their academic process. Similarly, the lack of student autonomy in the development of academic activities, specifically in virtual programmes, was considered a persistent contributor to the occurrence of dropout (Meisalo et al., 2002), hence, P&GOs focused on strengthening student autonomy in order to mitigate dropout rates in both virtual and face-to-face training programmes (Gildehaus et al., 2019). Similarly, rural students in the study developed by Lewine et al. (2019) showed higher levels of motivation leading them to complete their higher education studies, explaining this phenomenon in the equivalence of effort, thus stipulating a curvilinear hypothesis of resilience in those who face more obstacles in their higher education, as is the case of rural students, seek to have better results in their formative process due to the additional effort they have to do in order to stay linked to the HEI (Lewine et al., 2019). However, fear of failure can mitigate the resilience curve, especially in the first year of study (Pillay and Ngcobo, 2010). Finally, rural students' procrastination affects their academic performance and may lead them to drop out due to loss of purpose (Warner 1993).

Socioeconomic determinant.
Regarding family income, research has shown that rural families are vulnerable compared to their urban counterparts, which makes this variable a predictor of student attendance at HEIs, as well as of dropout. Castleman and Meyer's work (2020) found that students tend to come from low-income families and adverse social backgrounds, which results in high drop-out rates due to the influence of variables such as work obligations, personal obligations and high costs associated with study. This was corroborated by Rueda et al. (2020). In this context, and considering the family's economic difficulties, students often take part-time or full-time jobs to cover their personal and educational expenses, however, as related by Lewine et al. (2019) paradoxically this can generate conflicts because having an additional income, the family may begin to demand the student to share their money to cover non-academic expenses, which worsens the student's financial condition and may influence the student's dropout. Otherwise, if the student is unable to find a job or has lost his or her job for various reasons, he or she is more likely to drop out of school. (Muñoz, 2013; (De Hart and Venter, 2013). However, it is necessary to recognise that in countries where social asymmetries are not so marked, as is the case in the Nordic countries, or with efficient educational policies (e.g.: free tuition). that allow rural students to be linked to the higher education sub-system, the results of studies indicate that family income does not have a significant impact on student permanence (Bania and Kvernmo, 2016).

On the other hand, low family income affects the student's experience at HEIs. Thus, Hines et al. (2015) noted that African American students from rural areas of the United States tended not

to participate in pre- and extra-curricular paid activities which made it difficult for them to adapt to the higher education environment.

To compensate for the economic hardships faced by families, states have designed a series of public policies in the form of financial support that seek to eliminate the effect of these hardships in the event of dropout. Thus, the most common is related to the payment of tuition fees, either in the form of a scholarship or an educational credit (Lewine et al., 2019). In this way, the study by Qu (2009) showed through a mathematical model that this type of support is efficient in the rural population when the financing of tuition is close to or lower than the family's semester income, reducing the probability of dropping out, especially in the form of credit, while the opposite effect occurs when the cost of tuition is very high compared to the family's semester income. Despite the efforts of states to link state support to students based on their legal framework, not everyone can access this type of support, such as in the case of illegal migrants located in rural areas (Muñoz, 2013) or because of the student's lack of knowledge regarding access to this support due to a lack of information (Hines et al., 2015).

On the other hand, state support has only focused on economic aspects, which has meant that no other strategies have been developed to reduce dropout among rural students. An example of this was the study developed by (Rashid and Sarker, 2008) in which students who worked in state entities did not find it meaningful to finish their academic programme because it did not represent a better job position or economic income, hence the authors raised the suggestion to develop new supports not concentrated on academic level tuition.

In addition to the variables described above, it was identified that rural students have problems related to finding accommodation for their on-campus studies, due to the fact that HEIs are usually located far from rural areas and when institutions have student residences they do not prioritise this type of student (Pillay and Ngcobo, 2010), therefore, they are located on the outer periphery of cities where rent is usually cheaper, increasing their transport and mobilisation costs and longer distances, which results in the student's demotivation to continue their academic programme, as well as generating greater financial pressure for them and their families (Lewine et al., 2019). Similarly, rural students moving to urban areas often have nutrition problems, which is why some HEIs have developed food security plans, as expressed by Troester-Trate (2020).

Academic determinant.
Findings related to previous academic experience can be divided into two subcategories. The first concerns the academic performance of rural students at pre-higher education levels, where a relationship has been widely established between academic performance and higher education performance in terms of average grades (Bania and Kvernmo, 2016). As such, students who are better qualified in secondary school have a lower risk of dropping out at the tertiary level (Rapley et al., 2008; Faizullina et al., 2013; Hines et al., 2015; Lewine et al., 2019; De Hart and Venter, 2013), as well as those with high performance in specific subjects, as was the case for natural sciences in the medical school students analysed in the study by Faizullina et al. (2013). The second subcategory is related to disciplinary knowledge prior to the training programme, where student desertion in the rural population is directly related to the knowledge acquired in secondary school in specific undergraduate subjects. This was evidenced in the work of Meisalo et al. (2003) and Meisalo et al. (2002) in a group of engineering students, where those who had never seen programming ended their training process early.

However, with regard to the social capital acquired by rural students through their family and relatives, the literature has established that this capital is usually low due to the fact that they are the first generation to enter an HEI (Castleman and Meyer, 2020), this has repercussions on various academic aspects such as performance in the absence of a rigid support structure (Hines et al., 2015; Castleman and Meyer, 2020), or on motivational aspects (Hines et al., 2015) that can lead to students dropping out of the training programme. In line with the above, rural students often have difficulties in learning due to poor academic performance at previous levels and the lack of specialised support structures for them. That said, Meisalo et al. (2002) found in a rural population in Finland that the complexity of programming course content in an engineering faculty, combined with problems of student comprehension, led to the dropout of part of the student population in the first year of training. Similarly, Nishat et al. (2020) found that class difficulty expressed in content is often one of the reasons why rural students drop out.

Regarding university average for rural students, research by Castleman and Meyer (2020), Lewine et al. (2019), Meisalo et al. (2003), Meisalo et al. (2002) found that the higher the university average, the lower the likelihood of dropout. However, Castleman and Meyer (2020) noted that students in rural areas tend to enrol for fewer academic credits, which represents a lower number of courses taken per semester, resulting in a lower probability of timely graduation. On the other hand, Nishat et al. (2020) recognise that GPA can be positively influenced by P&GO when the student actively participates in additional tutoring and other services provided by these types of programmes within HEIs.

In relation to other variables, the selection of the training programme has a direct impact on rural student desertion, given that a poor choice results in a lack of motivation to continue their training process, leading them to drop out of the programme (Pillay and Ngcobo, 2010; Nishat et al., 2020). This is due to a lack of information prior to the selection of the academic programme or family pressures (Pillay and Ngcobo, 2010). Faizullina et al. (2013) reported that this variable is one of the main causes of dropout in medical schools in Kazakhstan. On the other hand, excessive academic work can lead to the phenomenon of dropout, as it competes in time with other student activities such as work and personal obligations imposed by their socioeconomic reality (Pillay and Ngcobo, 2010; Pérez et al., 2021). In addition, some of the academic activities are not adjusted to the realities of rural students, such as the use of hardware, software, and internet to which rural students often do not have access (Meisalo et al., 2002; Pérez et al., 2019).

On the other hand, the size of the school from which students graduated has an impact on dropout in the rural population, as observed by Wheat et al. (2003); students from small schools tended to leave school early. This is explained by Pillay and Ngcobo (2010) who point out that teachers in rural schools tend to have less training than urban teachers, and that the subjects taught do not cover the whole curriculum, which puts rural students at a disadvantage when entering HEIs and can lead to problems with students' academic progress (Warner, 1993). Finally, absence from class due to problems with work obligations or long commutes, as well as the crossing of subject timetables, can lead to students dropping out (Rueda et al., 2020).

Institutional determinant.
The P&GO programmes have become one of the central axes to prevent and mitigate the dropout of rural students by HEIs. Thus, Warner (1993) identified how these programmes strengthen the student's self-learning skills and autonomy to carry out their training process, which according to the author helps to reduce dropout rates. Similarly, Nishat et al. (2020) found that these

programmes not only strengthened students' specific skills, but also significantly increased their GPA compared to students who did not participate in these programmes. However, the opposite effect was recorded for students who did not participate in such programmes. This may be due to a lack of student interest in participating, or to the limitations of these programmes in HEIs, which may define activities that do not fit the profile of the rural student (Castleman and Meyer, 2020), or have limited channels of communication and participation (Meisalo et al., 2002). However, positive results are not achieved in all areas, as demonstrated by Troester-Trate (2020) in which activities developed in P&GO programmes such as the assisted meal plans did not have an impact on student retention in HEIs. Finally, and because of the evolution of information and communication technologies in the framework of this type of programme, multiple software applications have been implemented in favour of student retention. This is reflected in the work of Oliveira et al. (2018) who documented the use of the mobile application "MobilMonitor", in addition to the use of SAT in the Learning Management System to identify students in rural areas, in a Brazilian state, who require individualised pedagogical support to make an early intervention and achieve their permanence.

In terms of communication between rural students and HEIs, the diversification of channels allows for permanence and retention, as described in Castleman and Meyer's work (2020) in which the use of text messages was implemented in order to inform students about administrative and academic procedures to be carried out before and during the semester of study. On the other hand, in the case of virtual programmes, the absence of communication with the teacher is a predictor of desertion, since, as this academic model is based on self-learning, contact would be expected to focus on reinforcing the contents and clarifying doubts, hence HEIs with this type of training programmes seek various channels to facilitate communication between the teacher and the student (Meisalo et al., 2002).

In terms of content language, some HEIs neglect the linguistic variety of rural students, especially in developing countries, which hampers the learning process (Rashid and Sarker, 2008). Additionally, the requirement of a second language as a graduation requirement creates difficulties for some rural students, due to the limited competences developed at previous academic levels (De Hart and Venter, 2013; Rashid and Sarker, 2008). Finally, it was found that the recognition of knowledge acquired by students at previous educational levels or through work experience by HEIs encourages academic retention (Bania and Kvernmo, 2016).

Discussion and conclusions

As presented in the results section, based on the systematic review, important findings were made about dropout in rural higher education. The first relates to the countries that have led research on this event in the rural student population, where the United States, Finland, Australia, and Norway stand out, which shows the interest of developed countries in understanding and determining the causes of non-continuation of studies in the rural population, and, to a lesser extent, in developing countries. In this sense, it should be noted that the results of these studies are not generalisable, since, beyond the size of the sample, in which it is evident that most of the studies are characterised by very small samples (see Supplementary 6), such as Troester-Trate (2020), Gildehaus et al. (2019), Hines et al. (2015), among others; or, the type of study, there are strong social asymmetries between the economies of developing countries, which may render the findings meaningless outside the context in which the research was carried out, as stated by Guzmán et al. (2021b). On the other hand, after searching for documents in SCOPUS it was determined that dropout in the rural student population has not been of great interest to academic actors, despite the

growing number of publications since 2010, as evidenced by the limited number of studies found in the period from 1993 to 2020, and that, in comparison with other systematic reviews that addressed various perspectives of dropout and where the period of analysis was shorter than the present study, fewer documents were found, as presented in the reviews by Orellana et al. (2020) (n = 72) and Guzmán et al. (2020) (n = 31).

The second finding concerns the variables that have been studied in the framework of determinants, in which, of the 55 variables coded, 35% corresponded to the individual, 25% to the socioeconomic, 27% to the academic and 13% to the institutional. Having said that, the studies that made up the sample concentrated their main interest on the explanatory variables of the individual and academic determinants. Moreover, the multi-causality of dropout in the rural population is recognised, since its explanation is derived from the influence of multiple variables which influence those that make up the same determinant or those of others, as was detected in the case of the variables of gender, age, work obligations, personal obligations, family income, ethnicity or social group, state support, among others. This is in line with the theoretical approach proposed in this chapter (see Figure 10) and which has been used in previous research such as those developed by Guzmán et al. (2021b), Kemper et al. (2020) and Barragán and González (2017). On the other hand, it is necessary to recognise that there are variables that have been analysed in rural populations and not so intensively in other student populations in higher education, such as: cultural context, family dysfunction, ethnicity, the language of content, death of relatives, nutritional problems, racism, and migration status.

However, due to the limited number of studies identified in the high-impact literature related to dropout in rural higher education, there are future lines of research that can be addressed to establish explanatory or predictive models that account for the causes and high rates that occur in the rural population at the higher education level. An example of this is the study of the variables and causes that lead rural students in virtual mode to drop out, since the studies found are more than a decade old, in discordance with the evolution of this educational modality, in addition to its consolidation as one of the possibilities for access to higher education for the rural student population within the framework of public policies (Guzmán et al., 2021b); or, the study of variables identified in other contexts that may influence dropout at higher education level in the rural student population, and which have not been analysed, such as: armed conflict and the legal status of students (Muñoz, 2013), the effectiveness of financial support (Qayyum et al., 2019), learning preferences (Aragon & Johnson, 2008), the level of student resilience (Packham et al., 2004), commitment to the academic goal (Choi & Kim, 2018; Morris et al., 2008), level of engagement in pedagogical teaching strategies and classroom learning (Choi & kim, 2018).

Finally, both the results presented in this chapter and their discussion should be understood within the manifest scope of the study, such as the search limited to SCOPUS which, although it lists high-impact literature, it is necessary for future reviews to include other databases and search engines in which other documents can be found to enrich the analysis of the identified variables that indicate student dropout in rural higher education. On the other hand, the systematic review showed the relevance of prospective work on mathematical and statistical modelling that links the variables together, detecting the direct and indirect influence of the variables on the decision to drop out or persist in higher education and identifying intermediate variables that affect permanence in the education system and whose consequences are slow to manifest themselves. However, other limitations related to the method selected for the literature review include the heterogeneity of studies, the inductive analysis carried out in each of the documents, among others.

Consequently, the objective of this chapter was achieved, which was to identify the individual, socioeconomic, academic, and institutional explanatory variables involved in student dropout in rural populations, based on a synthesis of the evidence available in the SCOPUS database. A complementary contribution of this chapter is to provide a comprehensive view of dropout in the rural student population at the higher education level, which constitutes an advance for the strengthening of public and private policies of HEIs in order to prevent and mitigate the event in an effective and efficient manner, and thus consolidate the tangible and intangible benefits of higher education in the rural student population.

Supplementary Material
Supplementary 5.
Frequency of publication by year.
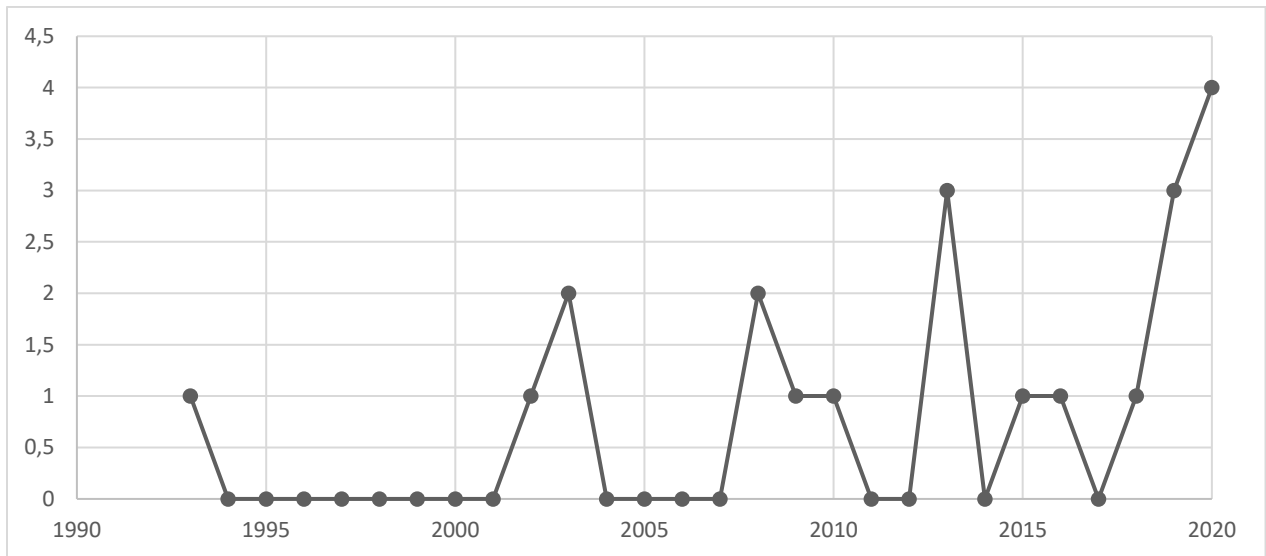
Supplementary 6.
Synthesis of the literature review studies.

Code	Type of study	Sample size	Type of data collection technique	Data collection instruments or data base	Data analysis and modelling techniques	Main results*
A1	Quantitative	4,881students	Survey	The Norwegian Arctic, Adolescent Health Study (NAAHS), Norwegian Patient Register (NPR) and the National Education DataBase (NUDB)	Pearson's chi-squared test for categorical data, and Student's t-test, one-way ANOVA for continuous data and multinomial logistic regression	Completion of upper secondary school is the only common predictor of a completed tertiary education degree for both sexes. Among females, behavioural problems were a significant predictor of lower-level education, usually in vocational occupations, while among males' severe mental health problems requiring treatment by the specialised health system reduced the chance of completing intermediate and higher tertiary education. Higher parental educational attainment was associated with less basic education among women and less tertiary education among men. Men residing in more northern and remote areas were less likely to complete tertiary education. Completion of tertiary education by males was strongly, but not significantly (p = 0.057), associated with higher mean grades in lower secondary school.

Code	Type of study	Sample size	Type of data collection technique	Data collection instruments or data base	Data analysis and modelling techniques	Main results*
A2	Quantitative	90 students	Survey	Banner (institutional database)	ANOVA statistical test	Results showed that 30 of 45 students in the Jefferson Community Schools programme were retained and 41 of 45 persisted. This compared to retention of 30 out of 45 and persistence of 42 out of 45 from the matched non-participating sample. The results of this study suggest that providing non-academic resources to low-income students may serve to equalise the chances of being retained or persisting when compared to peers with more resources of their own ($p < 0.05$).
A3	Quantitative	3,764 students	Programme information	Not applicable	Logistic regression	Using descriptive and quasi-experimental methods, we found that treated students were 6-6.7 percentage points more likely to persist through their first year of college, with modest gains in credit completion. These data suggest that universities can play an important role in communicating information about academic expectations, support resources and standards.
A4	Mixed	39 students	In-depth survey and interviews	Evaluation RAMP	Descriptive statistic and content analysis	This article described the reasons for the creation of this post, the qualifications of the RAMP, their training, their functions and the differences between the RAMP and

Code	Type of study	Sample size	Type of data collection technique	Data collection instruments or data base	Data analysis and modelling techniques	Main results*
						other posts commonly found in higher education. In addition, the evolution of the post was discussed and why it may be of interest to other institutions when addressing similar issues related to students from under-represented groups. Preliminary survey and focus group data from students directly advised by RAMPs indicated that RAMPs' holistic advising approach has had a positive impact on students' experiences by supporting persistence in degree programmes and providing psychosocial support for both personal and professional development.
A5	Qualitative	2 students	Semi-structured interviews	The instrument used and its origin are not specified.	Phenomenological analysis	Themes, based in cultural capital theory, that impacted their college persistence were identified within their pre-college experiences, college experiences and post-college perceptions. Recommendations for helping rural African American males attend and persist through college are offered.
A6	Qualitative	4 students	In-depth interviews and focal groups	The instrument used and its origin are not specified.	Categorical aggregation, direct interpretation, patterns and	The study found four categories that influence attrition: (a) financial stressors and missed opportunities, (b) the search for meaning in their college degrees as undocumented immigrants,

Code	Type of study	Sample size	Type of data collection technique	Data collection instruments or data base	Data analysis and modelling techniques	Main results*
					naturalistic generalisation	(c) coping with stress while navigating legal status, and (d) anxiety with navigating campus resources and climate.
A7	Quantitative	112 students	Survey	Special Tertiary Admission Test (STAT)	Descriptive statistics, Chi-square analysis, Mann–Whitney U test and logistic regression.	No significant differences were found between rural and metropolitan students who completed or withdrew from the course. Logistic regression analysis indicated that registered nurses in this sample with a hospital certificate rather than a technical school degree were more likely to complete the course: Location and years of experience as a registered nurse did not contribute significantly to course completion.
A8	Quantitative	1897 students	Survey	Academic Experiences Questionnaire QVA-r and the Family APGAR	Chi-square analysis and multiple correspondence analysis	According to the profiles obtained, the one containing the students with the highest risk of dropping out presents maladjustment and low adaptation to university life, they belong to single-parent families and present severe or moderate family dysfunction.
A9	Qualitative	78 students	Workshops	The instrument used and its origin are not specified.	Participatory Problem-Solving Intervention (PPSI)	The paper proposes a performance improvement model to reduce the dropout rate and ensure graduation with a better grade point average. After six semesters of intervention, the performance of participating students

Code	Type of study	Sample size	Type of data collection technique	Data collection instruments or data base	Data analysis and modelling techniques	Main results*
						was compared with that of students with a similar profile who did not attend the workshop. As the collaborative approach involves only peers, it benefits students by empowering them to solve study-related problems on their own and indirectly helps the development of self-esteem.
A10	Quantitative	60 students	Survey	The instrument used and its origin are not specified.	Descriptive statistics	The results showed the predominance of the female sex and rural origin as the profiles most susceptible to dropping out. The main causes of dropout and repetition were absences from classes, teachers who are not very explicit in their classes and who do not always follow the syllabus or syllabus when teaching content, little help given by the teacher in tutoring students, exam questions that sometimes do not fit in with the content taught, and the excessive amount of independent work.
A11	Quantitative	47 students	Survey	Beginning College Survey of Student Engagement (BCSSE) y Brief Resilience Scale (BRS)	Factor analysis and multivariate analysis of variance	The results after two full academic years are striking for the lack of difference in dropout rate and grade point average between these poor students and their university peers. it is suggested that it is not poverty per

Code	Type of study	Sample size	Type of data collection technique	Data collection instruments or data base	Data analysis and modelling techniques	Main results*
						se that leads to poorer university academic performance in these students, but rather the demand on their time and energy to meet ongoing financial needs.
A12	Quantitative	2,615 students	Survey	All Media Product Information Survey	Descriptive statistics and Cronbach's alpha	Ten multivariate comparisons indicated that rural students were always the highest dropouts. However, in four of these multivariate comparisons, rural students were also the lowest dropouts. Recommendations are made for specific interventions that could help support dropout-prone students.
A13	Quantitative	2388 students	Survey	The instrument used and its origin are not specified.	Descriptive statistics, the Z test for large samples and the Pearson correlation	Students in the first years of studies were more optimistic about the profession and had more intentions to work in the medical field than students in the last years. Only 8% of the students expressed a desire to work in rural locations. On the other hand, 4% of the students did not plan to work in the profession. On average, one in three medical students dropped out of medical school at their own request.
A14	Quantitative	435 students	Survey	Student Support Services Division of BOU	Descriptive statistics	The dropout rate for the 1st, 2nd and 3rd cycle was 51%, 41% and 67% respectively. The dropout rate is very high and increasing day by day. The

Code	Type of study	Sample size	Type of data collection technique	Data collection instruments or data base	Data analysis and modelling techniques	Main results*
						reasons for the high dropout rate could be due to language difficulty, lack of adequate recommendation in highly competitive job opportunities, lack of service incentives, financial support, scholarships, and recognition as cadre service by the government. Service incentives for graduates have been suggested to reduce the dropout rate.
A15	Quantitative	243 students	Survey	Stress and Support Questionnaire for University Students (SASQUS)	Descriptive statistics and Chi-square analysis	Fear of failure, financial and housing problems are high on the list, as well as the death of family members and significant others. Parents and friends are the most supportive. Significantly more women than men consider their friends and religious leaders-priests to be supportive. About a quarter of the sample felt that their siblings and health professionals were not supportive. Students under 21 years of age were more affected by conflicts with and between parents than those over 21 years of age.
A16	Quantitative	2508 students	Survey	Medical College Admission Test and Student Characteristics and Academic Performance	One-way ANOVA, Chi-square analysis, Analysis of covariance (ANCOVA) and	Medical students who graduated from small local universities were more diverse in terms of gender, race and rural background than other students. Students had slightly lower academic performance in medical school, were

Code	Type of study	Sample size	Type of data collection technique	Data collection instruments or data base	Data analysis and modelling techniques	Main results*
					logistical regression	more likely to drop out (10.6% versus 5.3% overall) and were more likely to be in rural areas of the host state.
A17	Mixed	95 students	Case study documentation	WIST programme information	Descriptive statistics and descriptive of case	Central Queensland University's access programme, Women into Science and Technology (WIST), a careful analysis of the needs of rural women has resulted in a community-based distance education programme, with a consultative approach to programme development and monitoring and strong student support systems. These systems include elements of both peer and institutional support. In the research framework the sense of ownership and relevance helps to mitigate dropout rates in rural higher education.
C1	Quantitative	Not applicable	Programme information	Promobile programme information	Descriptive of case	This paper shares experiences in two different settings: the capital and rural areas. In the case of the capital, the authors initiated a large-scale programme to address three aspects: (i) reducing student dropout; (ii) expanding the reachable community; (iii) offering different levels of knowledge. Four different learning activities were prepared: undergraduate and postgraduate

Code	Type of study	Sample size	Type of data collection technique	Data collection instruments or data base	Data analysis and modelling techniques	Main results*
						classes, a talent development programme, short-term events, and intensive training. In the case of rural locations, the authors describe the educational experience with undergraduate and postgraduate distance classes and ongoing research using learning analytics and adaptive models based on the Moodle LMS. The results are encouraging, as the measurement of the positive impacts of the reported initiative clearly indicates that a structured programme would bring solid and lasting benefits. Furthermore, it should be noted that the proposed solutions can also be adapted to other learning scenarios.
P1	Quantitative	Not applicable	Not applicable	Not applicable	Mathematical model design (diversified tuition model)	This paper finally establishes the diversified model that determines the criteria of higher education enrolment. To increase the funds of universities to promote their development, this paper analyses the relationship between the criteria of higher education enrolment and the proportion of dropouts with the help of statistical distribution theory. Therefore, this paper advocates raising the level of enrolment, which is equipped with a

Code	Type of study	Sample size	Type of data collection technique	Data collection instruments or data base	Data analysis and modelling techniques	Main results*
						well-established scholarship system, i.e., the policy of "high enrolment, high scholarship" that decreases the dropout rate as well as improves the teaching quality of universities.
P2	Mixed	67 students 11 students	Survey In-depth interviews	The instrument used and its origin are not specified.	Descriptive statistic and content analysis	The article evaluates the first programming course and modifies the course based on analysed feedback from students who drop out of the course. In the autumn of 2001, we extended to the rural region of a neighbouring province and evaluated the differences between the new and the old areas. The drop-out rate is somewhat higher in the new area. The course arrangements are the same in both areas, but we found factors, such as knowledge of the course rules, the experience and attitudes of the teacher-tutors, the students' own activities, as well as the students' previous experience of the programme, which may have influenced the drop-out phenomenon.
P3	Quantitative	222 students	Programme information	Not applicable	Descriptive statistic	In this programme, high school students pursue first-year university-level studies in computer science via the web, in parallel to their regular high school studies. Almost half of the

Code	Type of study	Sample size	Type of data collection technique	Data collection instruments or data base	Data analysis and modelling techniques	Main results*
						virtual studies offered focus on programming, which has proven to be the most difficult part of this curriculum. Most of those who drop out of the studies do so already during the first year of programming and at the latest during the second year. We have seen the difficulties in learning programming, especially in a virtual learning environment.

Note: code A refers to articles, C to chapters of books and P to conference proceedings. The list of document codes is available in

Table 3. *Results extracted from the documents under study.

Supplementary 7.
Explanatory variables found by document.

Document / Variable	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	C1	P1	P2	P3
Attitude			X																	X	
Adaptation to the HEI								X													
State support					X	X					X			X					X		
Self-learning																				X	
Autonomy			X	X																	
Equity capital			X		X																
Communication																				X	
Course contents										X											
Cultural context			X												X						
Learning disabilities									X											X	
Family dysfunction								X													
Educators										X										X	
Age												X		X							
Employability			X			X						X									
Teaching and learning strategies									X	X										X	
Stress														X						X	
Study of a second language									X			X									
Ethnicity												X									
Previous academic Experience	X				X		X				X	X	X							X	X
Lack of job opportunities													X								
Lack of time																				X	X
Academic failure													X								
Gender												X		X						X	
Language of the contents									X					X							
Absences from classes										X											
Social influence			X		X																
Family income	X				X		X				X									X	

Dissatisfaction with the programme														X			
Slow academic progress														X			
LMS															X		
Personal goals														X			
Fear of failure												X					
Motivation									X								
Death of relatives												X					
Parents' educational level	X																	
Labour obligations							X	X	X	X		X					
Personal obligations							X		X									
Poverty									X									
Nutrition problems		X																
Accommodation problems									X			X					
Scheduling problems																X	
Financial problems										X		X					
Relationship problems with parents												X					
Procrastination			X											X			
P&GO programmes		X	X	X	X	X	X		X					X	X	X	
University academic average					X		X		X								X
Racism					X												
Health reasons	X				X					X							
Knowledge recognition	X																
Academic programme selection					X		X			X		X					
Migratory status			X			X											
Rural livelihood																	
School size and type												X	X				
Academic work												X					X
Transfer to another university										X							
Use of ICTs											X						

Note: code A refers to articles, C to chapters of books and P to conference proceedings. The list of document codes is available in

Table 3.

Chapter Four: Rurality and Dropout in Virtual Higher Education Programmes in Colombia

Based on the systematised review of the literature developed in the previous chapter, it was necessary to identify the individual, socio-economic, academic, and institutional variables that influence the dropout of rural students who study online. This need is the result of two factors. The first one concerns the role of this modality in the current policies of access to rural higher education in Colombia, which are based on flexible modalities; and the second factor is related to the lack of recent studies on the variables that influence the dropout of rural students in the virtual modality. In this way, a first overview of the variables that explain this event in a developing country where rurality and virtuality are combined is provided.

Abstract

As part of the 2030 Agenda, higher education has been conceptualised as one of the ways to overcome the social disparities experienced in rural areas in Colombia. Thus, in concordance with the benefits of this level of education, the state has been designing public policies during the last few years, in order to facilitate access to undergraduate programmes to these populations, focusing mainly on the implementation of the virtual modality. In this context, it is recognised that access itself is not enough, but that continuance and timely graduation are required to materialise the benefits obtained along with a higher education degree; hence, dropout is a subject of interest for study, especially due to the high rates existing in the rural student population. Therefore, the event of dropout becomes an obstacle to social change and transformation in rural areas. Thus, this chapter aimed to identify which individual, institutional, academic and socio-economic characteristics influence rural student dropout in virtual undergraduate programmes in Colombia. For this purpose, an exploratory, quantitative and cross-sectional study was proposed, with a sample of 291 students to whom a student characterisation instrument and a classroom evaluation instrument were applied. With these data, it was proceeded to establish which of them had deserted, constituting the extraction of the sample of the study, which were 168. With the information, an exploratory factor analysis, hierarchical cluster analysis and descriptive statistics were used to establish which explanatory variables are involved in the dropout of this type of student. The results showed that the academic variables analysed do not have an impact on the event, while marital status (associated with family obligations), age, social stratum, work obligations, parents' level of education and type of work, income, and type of employment relationship of the student, and, finally, the number of people who depend on the family's income do.

Introduction

In Colombia, rural populations have been characterised by social disparities resulting from the armed conflict, drug trafficking, unequal access to land, corruption and state negligence, among other factors (Amaya de Ochoa, 2002; United Nations Development Programme, 2015; Ministry of National Education of Colombia, 2017; Ministry of National Education of Colombia, 2018). This has led to the fact that, from 9,512,141 people located in the rural areas (DANE, 2021), 47.5% live in monetary poverty and 19.3% in extreme monetary poverty or destitution (DANE, 2021). Hence, the State recognises that Higher or Tertiary Education is a central axis to overcome social inequalities in the country (Ministry of National Education of Colombia, 2017; Ministry of National Education of Colombia, 2018), especially in rural areas, so that, since the signing of the Peace Agreement and the Agreement for Higher Education, and in articulation with the commitments made in the framework of the 2030 Agenda, public policies have been designed to facilitate access to this educational level, focusing on the implementation of adaptable educational models, among

which undergraduate programs in virtual mode stand out (Ministry of National Education of Colombia, 2017; National Council of Higher Education, 2014).

In this context, it is necessary to recognise the role of higher education as an agent of development and social transformation in rural areas as it enables the improvement of average incomes (Cristia & Pulido, 2020; Montenegro & Patrinos, 2014), the increase in the productivity of the economy (Atchoarena et al., 2005; McMahon, 2010), a decrease in crime (Chalfin & Deza, 2019; Callender & Dougherty, 2018; Lance, 2011) and the growth in life expectancy (Smith-Greenaway, 2020; Currie & Moretti, 2003), etc. However, facilitating access to higher education for this type of population is not enough to transfer the individual and collective benefits or rewards of the educational level. It is also necessary to guarantee the permanence and timely graduation of this student population. For that reason, the event of dropout is one of the main barriers for the fulfilment of national public education policies, and of the 2030 Agenda itself, as it prevents the elimination of poverty, hunger, improves health and gender equality, among others. This has led the State to enact public policies to achieve permanence and timely graduation as a strategy for the elimination of social asymmetries in these areas (Allmendinger et al., 2019; Kim & Kim, 2018). Thus, these policies contemplate the intervention of the various protagonists of the education system, focusing on the role of the State and Higher Education Institutions (IES) (Ministry of National Education of Colombia, 2018).

That said, the state has followed its conservative line, through the financing of tuition and other expenses associated with the educational level (Moreno et al., 2019), which were represented in the form of credit lines and scholarship credits for these populations. An example of this is the "More Colombian than Ever", which facilitated access to higher education, in virtual programmes, for citizens located in the areas with the highest rurality indexes (Colombian Institute for the Evaluation of Education, 2019). Another example is the "Generation E" programme, which allowed students located in or coming from rural areas to access high quality accredited HEIs through the figure of scholarship credits covering the student's tuition and living expenses, and which were exempted from payment of the financial obligation if the participants covered satisfactorily their training process (Colombia Aprende, 2021). In the case of HEIs, the public policy has focused on strengthening and developing student competencies (Ministry of National Education of Colombia, 2017; Ministry of National Education of Colombia, 2018), in addition to the development of the Early Warning Systems (known in Spanish as SAT) and the Permanence and Timely Graduation Plans (PyGO for its Spanish acronym) in order to identify students at risk of dropping out due to individual, institutional, academic and socio-economic variables, and intervene in a timely manner through tutoring, vocational guidance, credit fairs and housing search, among others (Ministry of National Education of Colombia, 2018; Ministry of National Education of Colombia, 2015).

Notwithstanding the strategies implemented from the public policy for the prevention and mitigation of student dropout in rural populations, it was estimated by the Ministry of National Education of Colombia (2018) that the rate of ceasing at the undergraduate level is close to 50% for this population; there are indications that other characteristics present in the individual, in the same educational system, in the academic and social context influence student dropout, and these features have not been taken into account for the development of policies, resulting in ineffective prevention and mitigation in the event of dropout.

In this context, the lack of analysis of new explanatory variables of the event in this type of population derives, on the one hand, from the way in which the information of the System for the

Prevention of Dropout in Higher Education, (SPADIES in Spanish) is structured; this organization consolidates and organises the information for monitoring students who have entered the educational level in the country. However, it does not contemplate the rural condition as an explanatory variable of dropout, as well as other variables associated with it (Guzmán & Canovas, 2020). On the other hand, the lack of previous research developed by the academic community in the country results in the impossibility of appropriating the findings of the event of dropout in higher education in rural areas for the development of public policies.

The latter situation is not very different from the international level, where efforts to understand desertion were concentrated at earlier educational levels (e.g.: Bilige & San, 2020; Mughal, 2020; Ibarrola 2020) and the few studies developed at the tertiary level were carried out with the aim of comparing dropout levels between rural and urban students and their characteristics (e.g.: Lewine et al., 2019; Bungău et al., 2017; Byun et al., 2012), and in the identification of some variables that have an impact on dropout in these populations, such as: the effect of the tuition fee subsidy (Kim & Kim, 2018; Lewine et al., 2019; Qu, 2009), parental expectations, academic burden, the effect of late entry to higher education, GPA and social connectedness (Byun et al., 2012), as well as academic capital prior to higher education entry (Kim & Kim, 2018).

It is important to highlight that these studies were carried out in contexts of developed countries or with social realities that do not include such marked disparities as those of the Latin American context, and specifically the Colombian one (e.g.: Kim & Kim, 2018; Bungău et al., 2017; Byun et al., 2012; Qu, 2009; Snyder & Dillow, 2009). In new scenarios, these may lack any significance, not only for reasons of location, but also because the analysis is limited to the face-to-face modality, leaving aside the virtual modality, which was incorporated as the basis for access to higher education in rural areas by the Colombian state, and in various developing countries such as South Africa and India.

Due to the lack of studies that simultaneously address dropout, higher education, rural populations and the virtual modality, the aim of this chapter was to identify the individual, institutional, academic and socio-economic characteristics that influence rural student dropout from undergraduate programmes in the virtual modality in Colombia, in order to complement the elements of the judgment of those who formulate educational public policy for the Colombian rural student population, to provide a new panorama for the academic community of this situation in the country, and to strengthen this line of research at international level; especially in the disruptive scenario experienced by the pandemic of COVID-19, in which it is expected that dropout levels increase in a generalised manner in higher education, mainly in areas with high levels of inequality, as is the case of rural areas (UNESCO, 2020).

Thus, this chapter is structured in four main sections. The first section presents the literature review, the conceptualisation of dropout and the theoretical reference model of Ministry of National Education of Colombia; the second section describes the methodology developed to fulfil the research objective; the third section presents the main findings; the fourth and fifth sections present the discussion, the limitations of the study, the conclusions and the public policy implications of the study.

Literature review and theoretical framework

Literature review

Dropout in higher education in rural populations has not been a regular subject of study by the academic community, or by states in general. As argued by Gibs (1998), Snyder and Dillow (2010) who highlighted that the studies developed in understanding the unequal scenario in this type of population are scarce, and the progress made was limited to the identification of some explanatory variables of the event (e.g.: Byun et al., 2012) and the comparison with their counterparts (e.g.: Lewine et al., 2019; Byun et al., 2012), leaving aside some transcendental aspects for the understanding of dropout such as the modality in which education is provided and what this implies. Thus, the review of the literature in this chapter is based on general advances in the field of study, those related to the virtual modality and those concerning the rural population.

In this sense, research carried out on the individual determinant has shown that the variables grouped together in this determinant can explain to a large extent the event of dropout, due to the fact that they consider personal and unique aspects of the student (Chalfin & Deza, 2019; Georg, 2009). Thus, in the case of the gender variable, the studies were contradictory in explaining dropout in higher education. An example of this is Ghignoni's findings (2017), which expressed that women were more likely to drop out, while Cochran et al. (2014) and Van Bragt et al. (2011) stated that men are more likely not to complete their higher education studies. This contradiction stems from the nature of the studies carried out, which were observational and limited to very specific student populations, so their results are not generalisable. In this context, the limitations of the variable should be acknowledged, and it is often related to other variables to explain the dropout event, such as age, family, and personal obligations, among others (Arias-Velandia et al., 2018).

On the other hand, in relation to age, it was established that older students are more likely to drop out of higher education (Beck & Milligan, 2014), however, like gender, this is related to other variables, especially family and work obligations that hinder their educational process (Cochran et al., 2014; Arias-Velandia et al., 2019; Yasmin, 2013; Packham et al., 2004). It was found that students increased family obligations by taking on roles other than that of a child, which increase the likelihood of dropping out (e.g.: Arias-Velandia et al., 2018; Packham et al., 2004). In the case of work obligations, students with financial difficulties often develop work activities that compete in time with academic activities, which can hinder the academic training process (Packham et al., 2004; Rice et al., 2013).

Another explanatory variable related to student dropout, in the individual determinant, is associated with family educational background, since the higher the educational level of the mother is a positive influence on the academic performance of the student, which generates a positive effect on both the emotional and cognitive aspects that leads to permanence and academic achievement, which is in line with the theory of educational capital (Cochran et al., 2014). Similarly, in relation to parental employment, it was found that the less qualified the parents are, the higher the probability of the student dropping out during the first years of study, due to both the instability of family income and the lower economic availability to cover additional items required by the student in their educational process (Li & Carroll, 2020; Park & Choi, 2009). However, the literature has shown that students with more siblings with a professional degree are less likely to drop out (Giovagnoli, 2002). In addition, there is another set of individual determinant variables that can influence the completion of professional studies, such as health status (Giovagnoli, 2002; Vera, 2020), ethnicity (Byun et al., 2012; Cochran et al., 2014; Yasmin, 2013), digital competencies and skills (Orellana et al., 2020; Choi & Kim, 2018).

In relation to the explanatory variables of the socio-economic determinant, these were the subject of analysis due to the inequality experienced in societies, which generates an educational disadvantage that has a direct impact on dropout rates (Chalfin & Deza, 2019). Studies on this type of variable were divergent, as there are two trends. The first indicates that socio-economic variables do not influence dropout in higher education (e.g.: Schmitt et al., 2020; Contreras, 2018), which gives greater relevance to other determinants to explain the dropout event (Palacio et al., 2020). The second indicates which of these socio-economic variables contribute directly to dropout in concordance with those of the other determinants (Adrogue & García de Fanelli, 2018).

In the latter line, it was found that both households and students with low income tend to be more likely to drop out (Adrogue & García de Fanelli, 2018) due to the lack of subjective well-being of the student, as argued by Soons et al. (2009). Similarly, financial insecurities stemming from the student's unstable job may lead to non-completion of studies (Erdogan, 2012). Regarding research that relates the variable of social stratum, understanding this as a classification of the property or dwelling occupied by the student and their family that accounts for the socioeconomic condition of these, the employment situation, the economic income of the family nucleus and the student, showed that students with lower income levels have several disadvantages when entering higher education, given that the accumulated social and cultural capital is usually lower than that of people with higher incomes (Palacio, 2020), which directly influences the academic determinant variables that can lead students to drop out.

However, regarding the academic determinant, multiple studies have identified that the academic capital achieved by students at levels prior to higher education constitutes one of the main risks of dropping out, given the academic demands of the educational level (Choi & Kim, 2018; Heidrich et al., 2019; Stewart, 2015). Therefore, in general, students with low grades in secondary school are at a higher risk of dropping out (Rice et al., 2013). Similarly, academic performance during the first years (Stewart, 2015) of higher education, as well as the resulting performance during their formative process, has a direct impact on dropout (Stewart, 2015). On the other hand, the explanatory variables of an academic nature are usually related to various psychological aspects of the student, such as self-efficacy, self-management, self-education, autonomy and critical thinking, which are required throughout the training process and whose absence especially affects students in virtual mode (Orellana et al., 2020).

A more recent perspective in the analysis of dropout due to academic aspects is related to the policies of access to higher education for vulnerable populations, in which it has become evident that these populations may have similar qualifications to those students who do not present vulnerabilities. However, they present a greater probability of not completing their studies due to the influence of socio-economic variables that prevent the development of the training process under equal conditions, for example, the lack of access to a computer or the internet (Orellan et al., 2020; Cerezo et al., 2015; Choi & Park, 2018; Guzmán et al., 2020).

Finally, studies relating to institutional variables have focused on the characteristics of HEIs, such as their size, as represented by the number of students, the quality of training programmes and administrative processes (Choi & Kim, 2018; Armstrong et al., 2018). Thus, it was found that flexible admissions policies and the lack of student support through university welfare plans are related to higher drop-out rates (Park & Choi, 2009). In the case of the latter, it was established that higher investments in these plans result in higher retention rates, especially in

private HEIs, as well as in graduation rates across the board at the educational level (Webber & Ehrenberg, 2009).

On the other hand, the role of teachers has a direct impact on the event of dropout. Thus, the lack of communication with them, especially due to the structure of the virtual pedagogical models, transgresses the student's perception, leading them to drop out (Guzmán et al., 2020). Another variable of this determinant is the configuration of the number of students per teacher, where the higher the ratio, the greater the possibility of early termination of the training process due to the lack of personalisation of education (Orellana et al., 2020).

Dropout and theoretical framework

Student dropout was approached from both the academic community and public policy actors (Kem et al., 2019), thus its conceptualisation was developed according to context-specific criteria, ranging from dropout in a specific course (Lehan et al., 2018), university programmes to the tertiary education system (Xavier & Meneses, 2020). In this sense, this chapter is framed at the level of university programmes, in which two types of perceptions are evident. The first one obeys a construction from the research advances, in which the authors make conceptualisations based on the analysis of the event in a delimited context. An example of this is the definition of dropout, in which this event is understood as the student's decision to terminate their educational process before its culmination (Zuñiga, 2006) due to the influence of various explanatory variables, whose interaction establishes causes that precipitate the non-completion of his or her higher education studies (Giovagnoli, 2002); alternatively, the one caused by various projects such as ALFA GUIA, in which dropout is defined as "an event of a complex, multidimensional and systemic nature, which can be understood as a cause or effect, failure or reorientation of a training process, choice or forced response, or as an indicator of the quality of the education system"(Proyecto ALFA GUIA DCI-ALA/2010/94, 2017, p. 6).

The second type of perception has an operational nature, being developed from public policies to facilitate the measurement of dropout at the higher education level, as well as the evaluation and monitoring of some variables. For the Colombian case, the Ministry of National Education of Colombia (2015) establishes dropout as a function of the time in which a student was not linked to an HEI, being considered a dropout if they did not register to enrol in the training programme in two consecutive periods (semesters), and is not a graduate, or withdrawn for disciplinary reasons.

Having stated the concepts, it is important to highlight that these definitions of dropout are not mutually exclusive, but rather have specific purposes of analysis, having as a meeting point the understanding of the explanatory variables, the causes, and effects of the event, as well as the development of strategies for its prevention and mitigation, hence they have the capacity to feed back into each other. Therefore, the models suggested by academia were appropriated by states for the development of public policies related to dropout, as in the case of Colombia, where the Ministry of National Education of Colombia adopted the Tinto Interaction Model and Cox's Proportional Risk Model (Ministry of National Education of Colombia, 2009) as a framework for the discernment of this event, and, consequently, national HEIs according to their autonomy.

This model, in its original version, was developed by Tinto and Cullen [70] and then further developed by Tinto (1973, 1975), who took as a point of reference the student's emotional and intellectual background, which involves their individual characteristics, academic record and family background, all of which have a direct impact on their permanence in the HEI by allowing,

or not, their integration into the academic and social system, so that the relationship with both systems together with the initial commitment will result in the student's permanence or desertion. Thus, from a broader perspective, student dropout in HEIs is the result of a longitudinal process between the interaction of the above-mentioned systems (Barragán & González, 2017; Himmel, 2002).

In a generalised way, the model was of great academic value and was used in many works (e.g.: Barragán & González, 2017; Kemper et al., 2020; Klein, 2019; Radovan, 2019; Yepes et al., 2017). However, the model was evolving and incorporating new perspectives by various authors, including Heublein et al. (2010) and Heublein et al. (2002), who had considered the initial limitations of the model by including explanatory variables external to the academic and social system and treated them as direct variables of dropout. Thus, these authors addressed pre-university, inter-university and external variables to the student's academic environment to complement the original model and explained it holistically.

Based on the new version of the model proposed by Tinto (1973, 1975), and having considered its flexibility to include new variables that explain dropout, according to the educational modalities and realities of the students, as well as its potential for the development of explanatory and predictive statistical models that allow for a better understanding of the event in higher education in Colombia, the Ministry of National Education of Colombia adopted this conceptual model. Thus, in the version developed by the country's public policies, the interactions between the variables were grouped into four determinants: individual, socio-economic, academic and institutional. It is in this model of dropout that the present chapter is based. Table 4 conceptualises the determinants and gives examples of some of the explanatory variables associated with them.

Table 4.
Conceptualisation of the determinants of dropout, Tinto's Iteration Model adapted by Ministry of National Education of Colombia.

Determinant	Concept	Associated Explanatory Variables
Individual	These are the characteristics associated with the student and their personal environment that directly influence the decision to leave the learning process unfinished.	Age, gender, marital status, position in the number of siblings, health problems at the time of entering HEI, family environment, fulfilled expectations, family and personal obligations, conscientiousness, intrinsic motivation, etc.
Socio-economic	They refer to the influence of the social and economic context in which the student is involved, and which may lead them to not complete their higher education process.	Social status, employment situation, household and student income, economic dependency, the macroeconomic environment of the country, etc.
Academic	They are the achievement of learning outcomes, competence development, student performance and other factors that influence the teaching and learning process at all levels of education.	Previous academic performance, courses taken prior to higher education, secondary school leaving exams, results of entrance exams to higher education, teaching qualifications, levels of satisfaction with the academic programme, etc.
Institutional	These are the characteristics of HEIs which allow the proper development of the educational process.	Institutional policies, funding facilities, pedagogical resources, level of interaction between teachers and students, academic support, political support, etc.

Methodology

    Sample

       To fulfil the objective proposed in this chapter, an exploratory, quantitative and cross-sectional study was carried out. For this purpose, a non-probabilistic sample of 291 rural students, enrolled in undergraduate programmes in the virtual modality of an HEI in the city of Bogotá, was taken. The enrolment status of these students was monitored during the period from 2018 to 2020, detecting that 123 students continued their formative process while 168 dropped out, which formed the sample considered to be representative in accordance with the exploratory nature of the research, based on the parameters established by Patton (2015), as well as being similar to that of the studies developed by Contreras (2018), Oasi et al. (2019) and Guzmán and Rodriguez-Canovas (2020). Table 5 summarises some of the individual characteristics of the sample extraction.

Table 5.
Characteristics of the sample under study.

Characteristics	Results
Gender	Feminine: 54.2% Masculine: 45.8%
Age	17–18: 4.2% 19–25: 35.7% 26–30: 20.8% 31–35: 16.1% 36–40: 10.7% 41–45: 4.8% 46–50: 4.2% 51–more: 3.6%
Single father or mother	Yes: 31.5% No: 68.5%
Currently working	Yes: 79.2% No: 20.8%
Marital Status	Single: 53% Married: 16.7% Free Union: 25% Divorced: 3% Other: 2.4%
Social Stratum	1: 41.1% 2: 35.7% 3: 19.6% 4: 3.0% 5: 0.6%

Instruments

For data collection, an institutional self-reporting instrument called student characterisation was used, which was aligned with the individual, socio-economic and academic determinants of Tinto's Interaction Model (1973, 1975) adapted by the Ministry of National Education of Colombia. This was applied to the students in the sample at the time of entering the institution. The instrument consisted of 38 items, distributed into 17 explanatory variables corresponding to the individual determinant, 12 to the socio-economic determinant and 9 to the academic determinant. Supplementary material

Supplementary 8 shows the items with their respective response options.

In the case of the institutional determinant, it was not asked directly because it was applied when entering the institution, so the data from the virtual classroom evaluation was used for the study. This second instrument was composed of eight items that related aspects of subject content, tutoring and academic mentoring. Given the possibility of students dropping out early before the survey was completed, the student data were marked as zero. Supplementary 9 shows the items assessed in the instrument.

Data analysis

With the data collected, an exploratory factor analysis (EFA) was carried out to determine whether the explanatory variables of dropout assessed in both instruments were associated with each of the determinants proposed by Tinto's Interaction Model (1973, 1975) adapted by the Ministry of National Education of Colombia. For this purpose, the Kaiser-Meyer-Olkin (KMO) statistic, Bartlett's test of sphericity (BTS) and the anti-image matrix were used to check whether the data were suitable for this type of analysis. Based on the parameters of Godfred et al. (2019), variables with partial correlations of less than 0.5 in the anti-image matrix were removed from the factor analysis. Subsequently, using the criteria established by Cronbach (1951), Godfred et al. (2019) and Comrey and Lee (2013), the EFA was carried out using the principal factor method with Varimax rotation, eliminating items with factor loadings of less than 0.10. With the conformation of the factors, the analysis of internal consistency was carried out for each of these, using Cronbach's alpha statistic (α), in addition to each of the variables. Thus, α was considered moderate when the value was between 0.40 and 0.60, acceptable between 0.60 and 0.80, and high when it was above 0.80 (Cronbach, 1951). In the case of variables where their elimination would improve the value of the statistic, they were eliminated from the factors.

With the factors formed, a hierarchical cluster analysis was applied to subdivide the individuals in the sample into groups with homogeneous characteristics. This type of analysis does not use any kind of underlying statistical model, so no supervision is required to carry out the classification process. This type of exploratory analysis is appropriate when the purpose of the study is to identify distinctive traits in a population and is widely used when variables with d descriptors are observed, as in the case of Likert-type or multiple-choice scales (Tan et al. 2019). It is important to note that, because of the hierarchical nature of the analysis, it is based on a tree structure that allows the number of clusters into which the sample can be subdivided to be determined; for that reason, no prior knowledge of how the individuals under study could be classified is required (Tan et al. 2019). However, compared to the various algorithms used in this type of statistical analysis, in this study we chose to use Ward's method, given that it minimises the sums of squares of the deviations from the mean of each variable, which allows us to have homogeneous groups of individuals. In addition, the squared Euclidean distance interval was used

to establish similarities and dissimilarities between observations, and the normalisation of data values to eliminate the effects of the scales of the instruments used.

However, the differences between clusters were established using the Mann–Whitney U statistic, because the data did not fit a normal distribution, so the difference was considered statistically significant if the *p*-value was less than 0.05. Finally, descriptive statistics were used to identify the individual, institutional, academic, and socio-economic characteristics that influence dropout in groups of rural students in online programmes. Finally, the information was analysed using SPSS software.

Results

This section is divided into three parts. The first corresponds to the results of the EFA that show how the variables are agglomerated for the sample; the second presents the conformation of the clusters and their statistically significant differences; the third shows the characteristics of the clusters.

EFA.

In the initial conditions of the EFA, in which all instrument variables were included, the KMO statistic was 0.78, indicating that the variables were partially correlated. In the case of the BTS test, the value obtained was 4463.63 Chi-Square with a *p*-value of 0.00, so that the items of the study were adjusted for this type of analysis, as explained in the factors extracted in the present EFA. However, the analysis of the anti-image matrix showed that some variables were not strongly correlated, so we proceeded to eliminate those with values lower than 0.5.

With the elimination of variables A1, A4, A5, A6, I2, I8, I10, I11, I12, I13, I14, S2, S8 and S11 from the EFA, the new values of the KMO statistics and the value obtained from the Approx. The Chi-Square of the BTS were 0.85 and 3999.63 with a *p*-value of 0.00, respectively. Based on the above, we proceeded to the rotation of the variables for the conformation of the factors, identifying that these manage to explain 41.31% of the variance.

However, with respect to the conformation of the four factors, items A7, I7, A3, I1, and I6 do not load on any of them. Thus, in the first, all the variables related to the institutional determinant loaded; in the second, four of the individual and five of the socio-economic (I4, I9, I3, I1, S1, S12, S4, S9 and S11); in the third, five of the socio-economic and one of the academic (S2, S3, S6, S5, S8 and A2); and in the fourth, three of the individual and one of the academic (I16, I17, I6 and A8), that said, the grouping of the variables contemplated in this study differs from the grouping proposed by the Ministry of National Education of Colombia Model [23]. Table 6 presents the matrix of the rotated factors and the loading of each of the items of the instruments.

Table 6.
Matrix of rotated factors under varimax technique.

Code	Factor 1	Factor 2	Factor 3	Factor 4
IES6	0.98			
IES1	0.98			
IES2	0.97			
IES4	0.97			
IES7	0.97			
IES8	0.97			

Code	Factor 1	Factor 2	Factor 3	Factor 4
IES5	0.95			
IES3	0.95			
I4		0.69		
S1		0.55		
S2			0.10	
I9		0.41		
S12		0.38		
I3		0.37		
S4		0.36		
S3			0.72	
S6			0.66	
S5			0.64	
S9		0.14		
S8			0.27	
I1		0.15		
I16				0.62
I17				0.44
I6				0.40
S11		0.25		
A2			0.16	
A8				0.18

Regarding the reliability of the factors, factor one was considered high ($\alpha = 0.99$), and factors two, three and four were considered moderate with $\alpha = 0.54$, $\alpha = 0.54$ and $\alpha = 0.40$, respectively. However, as shown in Table 7, these values for factors two, three and four can be improved by removing items S9, S2, A2 and A8. Thus, the new values for Cronbach's alpha were 0.55, 0.56 and 0.53, respectively.

Table 7.
Values of Cronbach's Alpha statistic if items are removed from the factor.

Code	Values of α Factor 1	Values of α Factor 2	Values of α Factor 3	Values of α Factor 4
IES6	0.99			
IES1	0.99			
IES2	0.99			
IES4	0.99			
IES7	0.99			
IES8	0.99			
IES5	0.99			
IES3	0.99			
I4		0.39		
S1		0.49		
S2			0.56	
I9		0.53		
S12		0.49		

I3	0.51		
S4	0.52		
S3		0.48	
S6		0.35	
S5		0.36	
S9	0.55		
S8		0.49	
I1	0.54		
I16			0.19
I17			0.22
I6			0.34
S11	0.52		
A2		0.55	
A8			0.53

Factor one groups the explanatory variables IES6, IES1, IES2, IES4, IES7, IES8, IES5 and IES3; factor two I4, S1, I9, S12, I3, S4, I1 and S11; factor three S3, S6, S5 and S8; and factor four I16, I17 and I6.

Hierarchical cluster analysis

Taking the EFA as a reference, we proceeded to the development of the hierarchical cluster analysis, where the entire sample was processed as valid cases. Thus, the cut-off was made at the re-scaled distance 10 of the dendrogram (see Figure 12), defining two clusters: the first grouped 94 dropouts, while the second grouped 74.
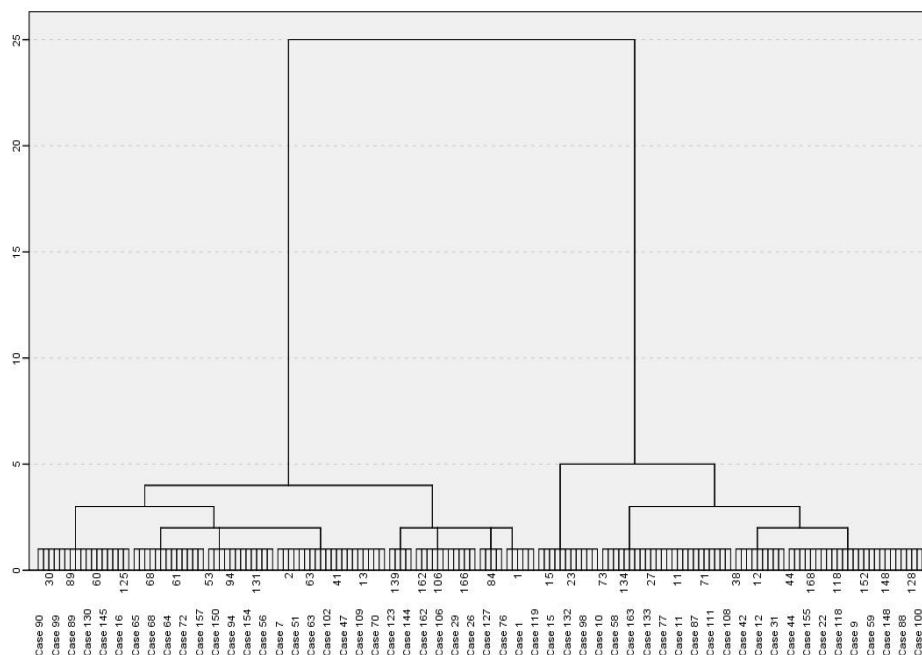

Figure 12. Dendrogram.
Note: The X-axis represents the sample dropouts, and the Y-axis represents the combination of rescaled distance clusters.

About the statistically significant differences between the clusters, it was identified that these are only present in the explanatory variables of factor one, as summarised in Table 8 and presented graphically in Figure 13.

Code	Mann-Whitney U	*p*-Value	Code	Mann-Whitney U	*p*-Value
IES6	1.50	0.00	I3	3237.00	0.39
IES1	2.50	0.00	S4	3001.00	0.078
IES2	5.00	0.00	I1	3471.00	0.97
IES4	35.00	0.00	S11	3214.50	0.37
IES7	1.50	0.00	S3	3261.00	0.32
IES8	44.00	0.00	S6	3299.00	0.55
IES5	52.50	0.00	S5	3086.00	0.19
IES3	81.00	0.00	S8	3369.00	0.70
I4	3470.00	0.97	I16	3233.00	0.39
S1	3179.00	0.30	I17	3395.50	0.77
I9	3273.00	0.39	I6	3299.00	0.51
S12	3388.50	0.766			

Table 8.

Mann–Whitney U statistical results.

Figure 13. Diagram of dispersion by factor.
Note: 1 (cluster one) and 2 (cluster two).

Cluster characteristics.

Cluster one

This cluster was made up of 51 women and 43 men who stated, with respect to the variables clustered in factor one, that the academic programme in which they were enrolled met their expectations (89.4%). In this case, 84.1% of the dropouts considered that the contents, materials and resources provided were useful and sufficient for their learning process. In turn, 70.2% said that tools such as academic forums allowed them to interact with tutors (teachers) and other
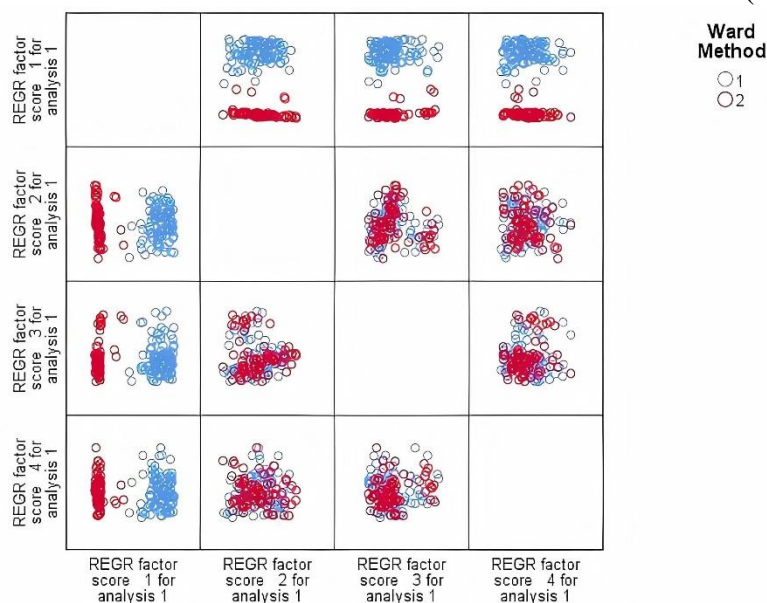
classmates, and 85.1% considered that the synchronous recorded classes helped them to clarify subject concepts. Concerning the resolution of doubts by the tutors, 76.6% said they were satisfied with their answers; additionally, 86.2% considered that the teachers had the necessary knowledge for the development of the course. Regarding the access and navigation facilities of the virtual learning environment, 84% reported being satisfied and very satisfied, while only 73.4% were satisfied with the role of the academic mentor, who is the person in charge of clarifying doubts and general concerns about the administrative processes with which the student is related. Finally, in this group, only one student dropped out early before completing the instrument.

Regarding the individual explanatory variables of factor two, 50% of the dropouts claimed to be single, 18.1% married, 25.1% living in union with their partner, 3.2% divorced and 3.2% reported another marital status. About the age of this cluster, 37.2% said they were under 25 years old, 41.1% between 25 and 35 years old, 17.0% between 35 and 45 years old, and 4.6% over 46 years old. In the case of the population vulnerability variable, 12.8% said they were displaced, 6.4% belonged to ethnic communities, 4.3% were victims of the armed conflict, and 76.6% did not present any condition of vulnerability. In the case of the socio-economic variables grouped in this factor, 38.3% of the dropouts reported belonging to stratum one, 36.2% to stratum two, 20.2% to stratum three and 4.3% to stratum four. In turn, 54.3% were looking for job offers, while 55.7% were not. On the other hand, regarding the occupation of their parents, 1.1% stated that the mother worked and studied, 9.6% worked occasionally, 24.5% worked permanently, 3.2% were pensioners, 46.8% worked at home, 12.8% were unemployed and 2.1% did not know her or she had died. One percent did not know or passed away; while 19.1% said the father worked temporarily, 36.2% worked permanently, 6.4% were pensioners, 6.4% worked at home, 3.2% were unemployed and 28.7% did not know or were dead.

In the case of factor three, 81.9% of the students who dropped out said they worked, and 10.6% earned less than the minimum wage, 17% the minimum wage, 27.7% between 820,858 to one million pesos (224 USD to 273 USD), 17.9% between one million to two million pesos (273 USD to 547 USD), and 8.5% more than two million pesos, while 4.3% had no income at all. Regarding the length of time they were employed, 30.9% had been employed for less than one year, 9.6% for one to two years, 10.6% for two to four years, 33% for more than four years and 16.0% had no employment relationship. Regarding the relationship between family income and the people who depend on it, 39.4% reported that they depended on this income between one to two people, 45.7% between two to four people, 13.8% between five to six people and more than seven people, 1.1%.

Finally, for factor four and the explanatory variables associated with it, 1.2% of the clustered dropouts considered their ICT skills to be poor, 24.5% fair, 33.9% good and 12.8% excellent. In the case of the parent's level of education, 55.3% said that their mother had primary school or lower, 28.7% had high school, 7.4% had a technical or technological degree and 7.4% had a vocational qualification; while 58.5% said that the father had primary school or lower, 25.5% had high school, 5.3% had a technical or technological degree, 6.4% had a vocational qualification and 2.4% had postgraduate training.

Cluster two

This cluster was made up of 40 women and 34 men, with the majority of the students who dropped out early (70). Considering what was previously stated, the student characterisation instrument was completed by all the dropout students, while the classroom evaluation instrument

was completed by only four students because of the observed phenomenon of early dropout. Given the above, for factor one, the analysis describes the particularities of the four dropouts, and for the descriptive analysis of factors two, three and four, all individuals clustered in this cluster were included.

Thus, the deserters were characterised by being very dissatisfied with the totality of the explanatory variables associated with factor one, whereby, the academic programme did not meet their expectations; the content, materials and resources provided were not useful and sufficient. On the other hand, they considered that the academic forums did not allow interaction with tutors and students, and that the synchronous classes did not support their learning process. In the case of the resolution of doubts by tutors and mentors, they expressed that these were not clarified, as well as evaluating the virtual learning environment negatively.

In the case of the explanatory variables of factor two, the dropouts in this cluster reported that 56.8% were single, 14.9% were married, 24.3% lived in union with their partner, 2.7% were divorced and 1.4% reported another marital status. About age, 43.2% said they were under 25 years old, 31.1% between 25 and 35 years old, 6% between 35 and 45 years old, and 19.7% over 46 years old. In the case of the variable of population vulnerability, 18.9% said they were displaced, 6.8% belonged to ethnic communities, 2.7% were victims of the armed conflict and 71.6% did not present any condition of vulnerability. On the other hand, the dropouts indicated that 44.6% belonged to stratum one, 35.1% to stratum two, 18.9% to stratum three and 1.4% to stratum five. In turn, 40.5% were looking for a job offer, while 59.5% were not. Concerning their parents' occupation, 2.7% stated that the mother worked and studied, 9.5% worked occasionally, 18.9% worked permanently, 2.7% were pensioners, 45.9% worked at home, 6.8% were unemployed and 13.5% did not know her or she had died. In the case of fathers, 1.4% studied and worked, 20.3% worked occasionally, 29.7% worked permanently, 6.8% were pensioners, 5.4% worked at home, 2.7% were unemployed and 33.8% did not know him or he had died.

For factor three, 75.7% of the dropouts were working, where 4.1% earned less than the minimum, 17.6% earned the minimum, 24.3% earned between 820,858 and one million pesos (224 USD to 273 USD), 8.1% earned between one million and two million pesos (273 USD to 547 USD), and 6.8% earned more than two million pesos, while 8.1% did not earn any income. With regard to the length of employment, 24.3% had been employed for less than one year, 13.5% for one to two years, 14.9% for two to four years, 27% for more than four years, and 20.3% had no employment at all. Regarding family income and the people who depended on it, 37.8% reported that they depended on one to two people, 44.6% on three to four people, 14.9% on five to six people, and 2.7% on more than seven people.

In relation to factor four, 2.7% of the dropouts in this cluster considered that their command of information and communication technologies was bad, 23% average, 55.4% good and 18.9% excellent. In the case of the parent's educational level, 48.7% said that their mother had a primary school or lower level, 37.8% a high school diploma, 8.1% a technical or technological diploma, 1.2% a vocational diploma and 1.2% a postgraduate diploma; while 51.2% said that the father had a primary school or lower level, 29.7% a high school diploma, 9.5% a technical or technological diploma, 6.8% a vocational diploma and 1.4% a postgraduate diploma.

Discussions

As shown in the results section and based on the type of study developed in this chapter, there are several findings on the event of dropout that were found in relation to rural students

enrolled in virtual undergraduate programmes. Firstly, the EFA revealed that, for this student population, the explanatory variables of dropout analysed are associated with four factors that do not necessarily respond to the model proposed by the Ministry of National Education of Colombia (2015), as individual and socio-economic variables are combined in factors two and three, and academic variables are not linked in any of them. In the latter case, indications were generated that the variables explored in the instruments (e.g.: knowledge of the study plan, time of transition between secondary and higher education, completion of virtual courses, etc.) may not have an impact on dropout in this type of population, which allows us to discuss previous research related to the educational modality, such as Choi and Kim (2018), Stewart et al. (2015) and Orellana et al. (2020) who considered these variables critical for understanding student dropout. However, it is necessary to recognise that part of the limitations of the study in this determinant was the non-inclusion of variables such as the academic average prior to entering higher education, the average obtained in the semesters taken, the results of the state tests for entry to the educational level, as well as various psychological aspects related to the teaching and learning process. Therefore, future research should develop these aspects to have a holistic view of the event, and thus determine whether the academic explanatory variables do not affect student dropout in this type of students and modality.

Secondly, with respect to the hierarchical cluster analysis, the existence of two clusters was determined. The first one related to students who attended at least one semester before dropping out; the second one to those who dropped out early before finishing their first academic semester. Considering what was previously stated, the dropouts who filled out the virtual classroom evaluation instrument stated that they were satisfied or very satisfied with the institutional conditions evaluated, such as course content, interaction with tutors and classmates, and the role of the mentor, among others. Thus, in the first instance, the event of desertion in rural students enrolled in virtual programmes cannot be directly associated with the variables of the factor, so this result generates new perspectives complementary to those raised by Guzmán et al. (2020) or Webber and Ehrenberg (2009), who recognised the influence of these variables in the non-completion of the students' training process. However, further research is needed on the reasons for early school leaving, as there is a general lack of knowledge as to whether institutional variables play a key role in this group.

Finally, given that there are no other statistically significant differences in the other items of the instruments, the students who dropped out were characterised by being single, although part of the student population claimed to have a nuclear family. Furthermore, dropouts reported working part-time or full-time, so dropout is influenced by students' family and work obligations as supported by previous studies (e.g.: Arias-Velandia et al., 2018; Packham et al., 2004; Rice et al., 2013). On the other hand, the age of entry into higher education is late for both clusters one and two, as they entered undergraduate education after the age of 25 and may be more likely to drop out (Beck & Milligan, 2014; Proyecto ALFA GUIA DCI-ALA/2010/94, 2013).

In relation to the conditions of vulnerability, such as armed conflict or forced displacement, the majority of deserters reported that they did not have such a condition. However, it is a variable that has been little explored in the literature, so it should be studied in greater depth in both rural and urban populations, given that when associated with other variables it can be a catalyst for dropout in higher education, as Yasmin (2013) argues. However, the variables related to the parents of the dropouts showed that they tend to have low levels of education, concentrating on primary and secondary school, as well as unpaid jobs, such as housework or part-time work. This could

have an impact on rural student dropout in virtual undergraduate programmes, as supported by the relationships found by Ghignoni (2017) regarding the educational level of parents, and by Li and Carroll (2020) regarding the economic instability derived from poor working conditions.

Regarding socio-economic variables, and specifically related to the student's income, these were characterised as being less than one million pesos per month (equivalent to 284 USD), which, when associated with the student's family obligations, can lead them to drop out. This is also directly related to the strata reported by the sample, most of whom were in the first and second strata. That said, this type of variable influences dropout in the rural population enrolled in undergraduate programmes in virtual mode as it is a common characteristic of students, as stated by Adrogue and García de Fanelli (2018).

Finally, the results presented here should be analysed from the perspective of the limitations of the study, given its exploratory nature and the cross-sectional nature of the data, which do not allow us to evaluate changes in the values of the explanatory variables at different points in time apart from the first entry to the institution. However, the size of the sample and its restriction to a single HEI may lead to results that differ from those presented in this chapter when applying the instruments in other scenarios. In addition, there are other issues expressed throughout this discussion, which, if complemented in future research, could provide a more complete picture of dropout involving higher education, rural populations, and the virtual modality.

Conclusions

The study presented here aimed to identify the individual, institutional, academic, and socio-economic characteristics that influence rural student dropout in virtual undergraduate programmes in Colombia. In this sense, it was determined that students share common characteristics that affect the decision to end their educational process early, such as marital status (associated with family obligations), age, stratum, work obligations, educational level, type of work performed by parents, income, the type of employment relationship of the student, and finally, the number of people who depend on the family income.

Under this scenario, we have a new perspective of dropout in this population and modality in the country, finding divergences with studies conducted at the international level, and providing elements of judgment for decision-makers in terms of public policy for the prevention and mitigation of the event of dropout. In this sense, it is necessary to recognise that the current public policy in Colombia has focused mainly on the economic problems of students and on some academic and social aspects dealt with by HEIs. However, this type of strategy is not sufficient to effectively control dropout levels in this type of student population, given that it does not address some of the explanatory variables identified here.

Taking what was previously explained into consideration, the state must implement various policies that are directly or indirectly related to education, to complement existing ones. An example of this would be the subsidising of family income to alleviate the economic pressure that forces students to work, or lowering the entry age to higher education, which goes beyond the policies of the educational level and requires a link with previous levels and with the realities of each region. Despite these suggestions for public policies, it must be recognised that some of the variables identified can only be dealt with over time, given that their change is complex in the short or medium term, such as the educational level of the parents, the work they do or the social stratum linked to the student's living conditions.

Based on these elements of judgment, which should be addressed by the State, it would be expected to have a positive impact on the permanence and timely graduation of rural students enrolled in virtual undergraduate programmes, thus achieving the benefits of the educational level, making a significant contribution to the fulfilment of the 2030 Agenda, and most importantly, overcoming the social disparities that exist in rural areas.

Supplementary material
Supplementary 8.
Self-report instrument of initial student characteristics.

Code	Item	Response option
A1	Do you know the syllabus of the degree course you are going to start?	1: yes, I do, 2: I have looked at it, but I do not understand it, 3: I have seen it, but I have not studied it in depth, 4: I only know the subjects of the first semester, 5: I know it moderately and 6: I do not know it.
A2	After graduating, you:	1: you studied and completed a university degree, 2: you studied and did not complete a university degree, 3: you have not studied and 4: you are a recent graduate.
A3	From the time you graduated from high school, how much time elapsed before you enrolled in a Higher Education Institution?	1: less than three months, 2: between three and six months, 3: more than six months and up to one year. 4: more than one year and 5: do not remember.
A4	If you have studied and did not finish your studies, why did you not complete these studies?	1: was not of my interest, 2: did not meet my expectations, 3: due to poor academic performance, 4: family pressure, 5: work obligations, 6: difficulties with the educational institution, 7: financial difficulties, 8: personal commitments, 9: I did not like the mode of study and 10: not applicable.
A5	Of the following factors, which do you consider having been the most important in your career choice?	1: skills and abilities, 2: your vocation, 3: family, 4: school orientation, 5: income of professionals in this career, 6: low cost of tuition, 7: friends, 8: none and the way it was offered.
A6	Was the institution where you completed your high school education bilingual?	1: yes and 2: no.
A7	What was the main reason you chose to study online?	1: I don't have time to do it in any other way, 2: I consider myself a self-taught person, 3: I consider it the best option for my current way of life, 4: I find it the best way to learn and 5: I have no other option.
A8	Starting your professional training in the virtual modality generates:	1: fear because I think I lack time organisation, 2: fear because I don't know how the modality works, 3: fear because I don't handle ICTs well, 4: happy because I want to evolve professionally, 5: anxious but convinced that it was an excellent decision and 6: calm because I know that I will do very well.

Code	Item	Response option
A9	Have you ever taken virtual courses?	1: yes and 2: no.
I1	Gender	1: feminine y 2: masculine.
I2	Are you a single parent?	1: yes and 2: no.
I3	What is your marital status?	1: single, 2: married, 3: free union, 4: divorced, 5: widowed, 6: other.
I4	Your age is between:	1: 16 or less, 2: 17 and 18, 3: 19 to 25, 4: 26 to 30, 5: 31 to 35, 6: 35 to 40, 7: 41 to 45, 8: 46 to 50 and 9: 51 or more.
I6	How would you rate your IT skills?	1: poor, 2: bad, 3: fair, 4: good and 5: excellent.
I7	Do any of the following situations currently exist in your family?	1: poor family relationships, 2: death of a relative, 3: domestic violence, 4: sexual abuse or violence, 5: chronic illness of a relative, 6: separation of parents, 7: alcoholism or substance addiction, 8: forced displacement, 9: economic difficulties of the family and 10: none of the above.
I8	How many siblings have a higher education degree?	1: I have no siblings, 2: 1, 3: 2, 4: 3 and 5: 4 or more
I9	Please indicate if you belong to any of the following communities:	1: displaced persons, 2: ethnic communities, 3: victims of armed conflict, 4: terminally ill, 5: disability (sensory, motor or cognitive) and 6: none of the above.
I10	Which of the following situations have you encountered that have been affecting your living conditions?	1: alcohol consumption, 2: psychoactive substance use, 3: eating disorders, 4: promiscuity, 5: gambling or video games, 6: sexually abusive situation and 7: none of the above.
I11	Which of the following supports have you needed during your life, even if you have not received attention for them?	1: help to improve behaviour and school coexistence, 2: learning supports, 3: mental health support or counselling, 4: occupational therapy, 5: movement therapy or physiotherapy, 6: speech, hearing, or speech therapy, and 7: none of the above.
I13	Do you suffer from any chronic or permanent illness for which you need specialised care?	1: yes and 2: no.
I14	Would you like to receive support to learn how to manage your time better, acquire habits or improve your study skills?	1: yes and 2: no.
I15	Do you have any disability?	1: yes and 2: no.
I16	What is your mother's level of schooling?	1: primary or lower, 2: high school, 3: technician or technologist, 4: professional, 5: postgraduate and 6: not applicable.

Code	Item	Response option
I17	What is your father's level of schooling?	1: primary or lower, 2: high school, 3: technician or technologist, 4: professional, 5: postgraduate and 6: not applicable.
S1	What socio-economic stratum does your household belong to?	1, 2, 3. 4, 5 o 6.
S2	Type of affiliation to the General Social Security Health System:	1: contributory scheme, 2: subsidised scheme, and 3: no scheme
S3	Are you currently working?	1: yes and 2: no.
S4	Are you looking for a job offer?	1: yes and 2: no.
S5	What is your salary range?	1: less than the minimum, 2: the minimum ($820,857), 3: between $820,858 and $1,000,000, 4: between $1,000,001 and $2,000,000, 5: between $2,000,001 and $4,000,000, 6: more than $4,000,001 and 7: not working.
S6	How long have you been working?	1: no work, 2: 0–6 months, 3: 6–12 months, 4: 1–2 years, 5: 2–4 years and 6 more than 4 years
S7	El ingreso económico aproximado de su grupo familiar es:	1: less than the minimum, 2: the minimum ($820,857), 3: between $820,858 and $1,000,000, 4: between $1,000,001 and $2,000,000, 5: between $2,000,001 and $4,000,000, 6: more than $4,000,001 and 7: not working.
S8	How many people depend on this household income?	1: between 1 and 2, 2: between 3 and 4, 3: between 5 and 6 and 4: more than 7.
S9	Who pays for most of your studies?	1: spouse, 2: parents, 3: other relatives or third parties, 4: scholarship, 5: credit and 6: own salary.
S10	Your home is:	1: own or family fully paid, 2: own or family in debt, 3: rented and 4: loan or encroachment.
S11	What is your mother's main occupation?	1: studying, 2: studying and working, 3: working occasionally, 4: working permanently, 5: pensioner, 6: working at home, 7: unemployed and 8: not known or deceased.
S12	What is your father's main occupation?	1: studying, 2: studying and working, 3: working occasionally, 4: working permanently, 5: pensioner, 6: working at home, 7: unemployed and 8: not known or deceased.

Supplementary 9.
Self-report scale of initial student characteristics.

Code	Item
IES1	To what extent does the academic programme meet your training expectations?
IES2	To what extent were the contents, materials and resources provided useful and sufficient for your learning process?
IES3	To what extent does the forum facilitate interaction with the tutor and other colleagues?
IES4	To what extent have the recorded synchronous classes helped you to clarify key concepts of the subject and to face the assessments with greater confidence?
IES5	To what extent does the tutor respond in a timely manner to academic concerns related to the subject?
IES6	What is your assessment of the tutor's technical knowledge and clarity of answers?
IES7	To what extent does the virtual platform facilitate access and navigation to the contents and resources provided for your learning?
IES8	To what extent does the academic mentor respond in a timely and clear manner to the concerns and situations presented during the development of the subject?

Note: items were evaluated on a scale of 0 to 5. Where 0 corresponds to "no response" representing desertion before the application of the instrument, 1 "very dissatisfied", 2 "dissatisfied", 3 "neither one nor the other", 4 "satisfied" and 5 "very satisfied".

Chapter Five: Comparative Analysis of Dropout and Student Retention in Rural Higher Education

The previous chapter established a new perspective of dropout in the rural student population and of the modality in the country, finding divergences with international studies and new explanatory variables that must be incorporated for the correct treatment of the educational phenomenon studied here. In this context, and as a result of the discussions in the third chapter of this thesis, this chapter expands the identification of these variables, moving away from a single HEI and contemplating students from several institutions where those of face-to-face modality are involved.

Abstract

The growing dropout and low permanence of rural students in higher education has become a central problem in the education system, affecting both the quality conditions of training programmes and preventing the materialisation of the benefits that the bonding to the educational level entails for the society. However, the study of these events in rural populations is scarce, resulting in an inadequate treatment of dropout and, consequently, the impossibility of consolidating student permanence. Thus, the aim of this chapter was to identify which individual, academic, socio-economic, and institutional variables influence the dropout and the retention of the rural student population in higher education. To achieve the purpose, a cross-sectional study was defined. The sample used was a non-probabilistic sample with an n of 269 rural Colombian students, who were administered a self-report questionnaire that assessed 59 variables. Data analysis was based on means comparison and cluster modelling. The results showed that drop-out and permanence in rural students is related to the educational level of the father, family and work obligations, the need to move from their place of residence, the academic average in high-er education, satisfaction with the choice of programme, communication with the institution, the attention of teachers, among others.

Introduction

The term quality is widely used in higher education systems worldwide to ensure excellence at both the institutional and training programme levels (Brown, 2004; Dill & Soo, 2005; Liu, 2021). In this sense, it is necessary to recognise that before the 1980s, quality in higher education was an internal matter for Higher Education Institutions (HEIs), however, after the 1980s, quality at the level of training became a matter of public policy, making quality assessment an internal activity of HEIs as well as an external activity of interest to states (Eaton, 2010; Eaton, 2012). Thus, in the quality assessment exercise, various standards which allow the knowledge of the current state of the substantive functions (teaching, research, and relations with the external sector) as well as those complementary to these functions have been generated (Duque, 2021).

In this scenario, there are multiple indicators that evaluate the quality of the educational system, the HEIs and the training programmes, however, the student dropout rate and its counterpart, the permanence rate, have become one of the main indicators (Aparicio-Chueca et al., 2021; Li & Carrol, 2020; Segovia-García & Said-Hung, 2021), since they allow us to identify whether the training programmes manage to provide society with professionals to meet the diverse demands that society generates on a continuous basis (Duević et al., 2018). Hence, if a HEI, a training programme, or an education system does not rank below the average drop-out rate at national or global level, it is of low quality, leading to intervention through the development of institutional policies and public policies to avoid this scenario.

The intervention generated by both HEIs, and the State is not only related to the outcome of the drop-out or permanence rate, but also to the effects that these educational events bring to society, by limiting or achieving the materialisation of the benefits of higher education (e.g.: higher income, increased productivity, and better security rates, etc.) (Guzmán et al., 2021b). This makes both drop-out and permanence at the educational level a matter of interest for the academic community as well as for policy makers.

In accordance with the above, many studies have sought to establish the variables that explain the materialisation of these events both in HEIs (Guzmán et al., 2021b; Arias-Velandia et al., 2018; Stoessel et al., 2015; Orellana et al., 2020; Heidrich et al., 2018; Barragán & González, 2017, Guzmán et al., 2020) and in the education system (Choi & Park, 2018; Callender & Dougherty, 2018; Adrogue & García de Fanelli, 2018; Guzmán et al., 2021c; Amare & Simonova, 2021; Castro-Lopez et al., 2021; Barragán & Gonzalez, 2022). However, their study still lacks multiple perspectives, generating indications that HEI and state policies have not been effective, thus persisting high drop-out rates and low permanence in education systems. An example of this is the situation in OECD countries, where in 2018 the dropout rate was close to 64.5%, or in the case of Latin America, where the dropout rate was close to 54% (Guzmán et al., 2021a). In addition, the dropout rate since the beginning of the COVID-19 health crisis has increased, especially among vulnerable student populations (e.g.: those displaced by conflict, Afro-descendants, and rural populations, among others) (Lischer et al., 2021).

Within the framework of perspectives that have been little addressed by both academic actors and education policy decision-makers, the study of dropout and permanence in rural populations is placed (Guzmán et al., 2021a; 2021b). Considering that, both HEIs and states have dealt with dropouts in this student population with generic strategies that apply equally to all types of students, without considering the individual, academic and socio-economic aspects of the students and the institutions in which they study This has led to an increase in the dropout rate and a low permanence rate, thus affecting the quality of the training programmes offered in these areas (Byun et al., 2012). Hence, it is necessary to evaluate the institutional and public policies that should be implemented in the rural student population to prevent and mitigate the event of dropout, to achieve the permanence of this type of student in the education system. In the analysis of this problem for rural students, the need arises to know what variables influence the decision to abandon or remain in the educational process.

Thus, the aim of this chapter was to identify which individual, academic, socio-economic, and institutional variables influence the dropout and retention of rural students in higher education. The Colombian education system was selected for this study because most of the previous research on dropout or permanence of rural students has been carried out in developed countries (e.g.: De Hart & Venter, 2012; Bania & Kvernmo, 2016; Castleman & Meyer, 2020; Meisalo et al., 2002; Qu, 2009), and not in contexts of social disparity as marked as the Colombian case, where rural areas have been characterised by violence and conflict by various armed actors, which has led to marginalisation, inequality in the income of the population, regional differences and various social tensions (Guzmán et al., 2021b). Hence, this analysis in the Colombian rural population, as an added value, allows us to understand what other variables influence dropout or permanence, providing new perspectives for the academic community as well as for public policy and HEI decision-makers.

This chapter is structured in four sections. The first presents the theoretical framework and contextualisation of dropout and retention in Colombia and the studies developed; the second contains the methodology that allowed the fulfilment of the objective; the third shows the results; the fourth discusses the main findings and offers the conclusions of this study.

Theoretical background

Dropout and permanence in higher education.

Dropout as an event that affects education systems does not have a unique meaning, being the result of the different actors involved in its study, such as researchers, HEIs, states, social organisations, among others (Guzmán et al., 2021a). That said, the literature tends to conglomerate definitions of dropout into two main groups. The first group is a compilation of conceptualisations derived from the academic study of dropout; the second group is operational, established by states in the framework of education systems to facilitate the quantification of the event (Guzmán et al., 2021b; Xavier & Meneses, 2020).

In this sense, the present chapter is framed within the first group, which allows for the analysis of multiple variables that can lead to the early termination of a student's academic studies. Thus, drop-out is defined as "the cessation of the relationship be-tween the student and the training programme leading to a higher education qualifica-tion before the qualification is recognised. An event of a complex, multidimensional and systemic nature, which can be understood as cause or effect, failure or reorientation of a training process, compulsory choice, or response, or as an indicator of the quality of the education system" (Proyecto ALFA GUIA DCI-ALA/2010/94, 2013). The use of this meaning of dropout permits the integration of the perspectives of the study of this event. In the case of permanence, there is a greater consensus regarding its conceptualisation, which is understood as "the permanent initiative of HEIs to generate strategies to strengthen institutional capacity, which contribute to reducing drop-out rates". It is also an important element in the elaboration of "the institutional educational plan" (Ministry of National Education, 2013).

In view of the various actors involved in the research of dropout and permanence in higher education, the multidisciplinary orientation in its study stands out (Ministery of National Education, 2013 This has led to the examination of illustrative factors, both innate and external to the student, which can be categorised as: individual, socio-economic, academic, and institutional. This categorisation has been used in previous studies such as those of Fonseca and García (2016), Barragán and González (2017, 2022), Donoso and Schiefelbein (2007), Guzmán et al (2021a, 2021b), among others. In addition, the states have made use of this categorisation to define public policies to prevent and mitigate dropout at the educational level, as is the case in Colombia (Ministry of National Education of Colombia, 2009). Figure 10 presents the dropout model based on the categorisation of variables; each cluster of variables hereafter referred to as a determinant. It should be noted that the variables of one determinant have the capacity to relate to and influence another. These same determinants can, in fact, also explain the permanence in higher education.

The individual determinant explains the characteristics related to the student and his or her individual environment that specifically affect the choice of whether to leave the learning handle without completing it or to remain in it (Ministry of National Education of Colombia, 2009). In higher education, the individual determinant variables have been widely debated, as several research studies have largely attributed them to the materialisation of the dropout event (Behr et al., 2020). An example of this was evidenced in the study by Georg (2009), who found that 95% of dropouts from German HEIs were explained by the characteristics of the individual at the time of

entry to the institutions. The socio-economic determinant refers to the variables of the social and economic environment that affect the student and his or her family and that directly or indirectly affect dropout or permanence (Ministry of National Education of Colombia, 2009). Previous studies have been divergent, since some research has indicated that this type of variable does not influence dropout or permanence in higher education (e.g.: Schmitt et al., 2020; Velázquez & González) and others have highlighted the influence of these variables on student completion of the educational process (Palacio Sprockel et al., 2020; Erdogan et al., 2012; Soons et al., 2009).

relates to the achievement of learning outcomes, the advancement of proficiency, student performance and other components that impact the management of instruction and learning at all levels of instruction (Ministry of National Education of Colombia, 2009). In general, the findings of previous studies identify that the variables of this determinant have a great impact on student dropout and permanence in higher education, especially because of the demands of the educational level, as identified by Heidrich et al. (2018), Choi and Kim (2018), as well as Stewart et al. (2015). prior to transition to higher education (Orellana et al., 2020) and student mental angles (e.g.: self-efficacy and self-management) (Respondek et al., 2017) are closely related to dropout at the educational level.

Finally, the institutional determinant explains those characteristics of the HEIs that allow for the correct development of the educational process (Ministry of National Education of Colombia, 2009). Previous research has found that the high levels of attrition and retention in HEIs are related to their size in terms of number of students, the quality of the training programmes, programmes for permanence and timely graduation (P&GOs) and administrative processes (Choi & Kim, 2018; Armstrong et al., 2018; Lee & Choi, 2011).

Context of dropout and permanence in higher education in Colombia.

Student desertion and permanence as indicators of quality in higher education in Colombia began to be of interest to the State in 2003, with the implementation of the first strategies for the prevention and mitigation of desertion and the achievement of permanence (Ministry of National Education of Colombia, 2015). As a result of these initial efforts, there was a need to expand the study of student dropout and permanence through accurate and reliable information, and the National Education Ministry (NEM) consolidated both the state information system SPADIES (Sistema para la Prevención de la Deserción de la Educación Superior in Spanish) and various public policies. Simultaneously, the national academic community became interested in the study of these educational events.

In the case of the State, public policies aimed at preventing and mitigating dropout have been designed and implemented jointly with HEIs. Thus, the State has taken on the role of funder of students, providing educational credits and scholarships (Guzmán et al., 2021b; Guzmán et al., 2021c); and HEIs have focused on strengthening competences, as well as developing Early Warning Systems (SAT in Spanish) and P&GOs to identify and support students at risk of not completing their educational programme (Ministry of National Education of Colombia, 2018). As a result of these efforts and according to SPADIES data (2020), in the first semester of 2021, the dropout rate of the system was 7.6%; while for the second semester it was 12.8%. While the drop-out rates, as presented in Figure 14, are below those observed in the Latin American and OECD region, when analysing the situation of training institutions and programmes located in rural areas, the reality is different.

Thus, for the year 2016, it was estimated by the Ministry of National Education of Colombia that the dropout rate by cohort in rural areas was close to 50%, both for technical and technological levels as well as for the university level (Ministry of National Education of Colombia, 2017). However, at the national level in these areas the drop-out rate varies between departments or states. An example of this is the departments of Chocó, La Guajira and Putumayo where the drop-out rates for technical and technological programmes were 91.3%, 73% and 71.2% respectively, while for university programmes the departments with the highest drop-out rates were Putumayo, La Guajira and Arauca with 80.2% and 55.6% for the latter two (Ministry of National Education of Colombia, 2018). In both cases, these departments are characterised by high levels of social disparity (Guzmán & Rodríguez-Canovas, 2020).
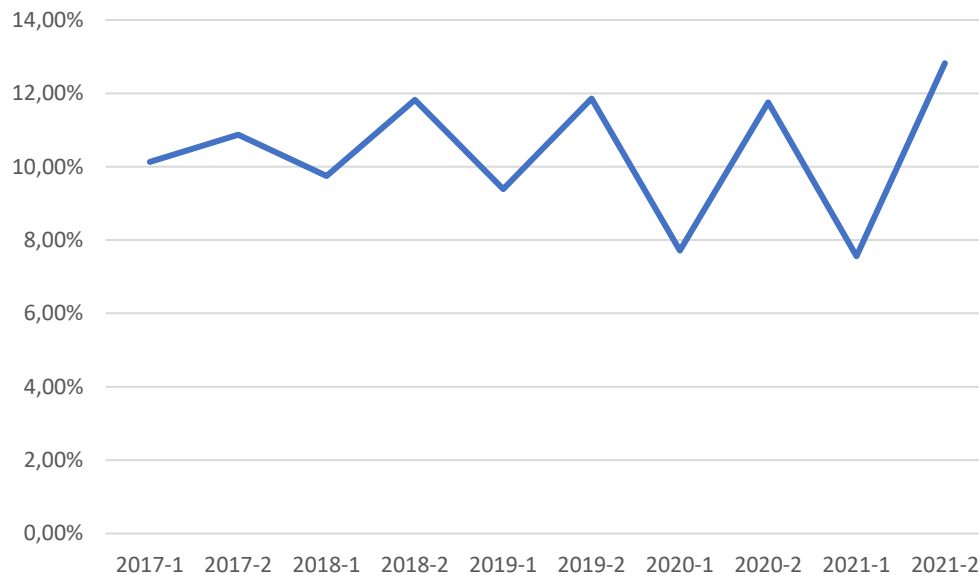

Figure 14. Dropout rate in the Colombian higher education system for the years 2017 to 2021.

However, in the case of public policies implemented by the State to prevent and mitigate the effects of dropout and achieve permanence in the rural student population, they are characterised by being non-differential, based on the financing and support of HEIs (Guzmán et al., 2021b). This is due to a certain extent to the lack of information on what is happening in the education system in these areas, a situation that is not exclusive to Colombia, but which is also present in other countries, as Byun et al. (2020) and Castleman and Meyer (2020) stated. Since government information systems do not incorporate the rurality variable, or the lack of academic interest in researching dropout and permanence in this student population (Guzmán et al., 2021a).

Having said that, in the case of the research developed in Colombia on desertion and retention of rural students in higher education, only three studies have been carried out. The first was carried out by Rueda et al. (2020), who determined that rural students who are at greater risk of dropping out were characterised by a low level of maladjustment or adaptation to university life, as well as belonging to single-parent families and with severe or moderate family dysfunction. The second, which was developed in virtual education training programmes, established that the academic variable do not influence the events of desertion or permanence, whereas conjugal status (related with family commitments), age, social status, work commitments, parents' instructive level and sort of work, the student's pay and sort of work relationship, as well as the number of individuals

who depend on the family's wage do influence the events of desertion or permanence (Guzmán et al., 2021b). Finally, the third, which assessed the potential of student drop-out in higher education to widen social gaps in rural Colombia, as it is the student and his or her family who bear the greatest costs associated with these events (Guzmán et al., 2021c).

Methodology

To fulfil the objective of this chapter, which was to identify the individual, academic, socioeconomic, and institutional variables that influence the dropout and permanence of rural students in higher education, a quantitative cross-sectional study was carried out, following the parameters established by Sedgwick (2014) and Cvetković-Vega et al. (2021). The sample, instruments and explanatory variables are described below, as well as the data analysis and modelling.

    Sample.

For the present study, a non-probabilistic, non-intentional sampling was defined, so that the selection of information-rich cases was sought, using Patton (2015) as a theoretical reference for the selection criteria of the participants, and three were established. The first is to be linked to an undergraduate training programme (technician, technologist or undergraduate); the second is to express the intention to drop out or remain in the training programme; and the third is to be in or come from a rural area. Based on the above, the final sample was 269 rural students, of whom 131 reported having the intention to drop out and 138 to remain in education. The sample size is like that of previous studies such as those developed by Guzmán et al. (2021b), Contreras (2018) and Oasi et al (2019). Table 9 presents the general characteristics of the study sample.

Table 9
General characteristics of study participants.

Characteristics	Result
Gender	Male: 40.89% Female: 59.11%
Age	17-20: 6.31% 21-24: 14.12% 25-28: 16.72% 29-32: 13.75% +33 years: 49.07%
Current semester	1: 27.14% 2: 11.52% 3: 7.81% 4: 10.78% 5: 9.29% 6: 11.15% +7 semester: 21.93%
Family income level	$0 to $500.000 pesos: 12.63% $500.001 to $1.000.000 pesos: 27.13% $1.000.001 to $1.500.000 pesos: 25.65% $1.500.001 to $2.000.000 pesos: 18.21% $2.000.001 to $2.500.000 pesos: 5.94% $2.500.001 pesos or more: 10.40%

Instruments and explanatory variables

An online self-reporting questionnaire was used to collect the data. The questionnaire was developed ad hoc based on the theoretical models proposed by Tinto (1973), Barragán and González (2017), Kemper et al. (2020), Guzmán et al. (2021a), Segovia-García et al. (2022), Heublein et al (2010), as well as Li and Carroll (2020), among others. The questionnaire was divided into six sections. The first sought to obtain informed consent and authorisation to participate in the study, and collected data from the students on their intention to drop out or remain in the training programme, as well as the type of programme they are studying; the second collected data on the variables of the individual determinant; The third focused on the socio-economic determinant variables; the fourth assessed the academic determinant variables; the fifth was related to the institutional type variables; and the last sought to confirm the student's rurality condition. Table 10 shows the variables analysed by the questionnaire designed and their theoretical contribution. For this support, the advances in the field of study related to rurality and in those variables not dealt with in previous research on the rural student population were taken as well as the basis of the research developed on other types of students. Similarly, Supplementary 10 presents the instrument and the coding of the study variables.

Table 10.
Explanatory variables assessed.

Determinant	Variable	Theoretical references
Individual	Age	(De Hart & Venter, 2013; Pillay & Ngcobo, 2010)
	Gender	(De Hart & Venter, 2013; Bazlur & Sarker, 2008)
	Work obligations	(De Hart & Venter, 2013; Nishat et al., 2020; Pérez et al., 2019)
	Family obligations	(De Hart & Venter, 2013; Nishat et al., 2020)
	Marital Status*	(Barragán & Gonzalez, 2022)
	Parents' level of education	(Gildehaus et al., 2019)
	Student psychological traits	(Castleman & Meyer, 2020; Nishat et al., 2020; Gildehaus et al. 2019)
Socio-economic	Type of dwelling*	(Choi & Park, 2018)
	Stratum	(Guzmán et al., 2021b)
	Access to public services*	(Segovia-García & Said-Hung, 2022)
	State benefits*	(Segovia-García & Said-Hung, 2022)
	Family income	(Bania & Kvernmo, 2016; Gildehaus et al. 2019)
	Methods of financing the studies *	(Arias-Velandia et al., 2018)
Academic	Type of school graduated from	(Pillay & Ngcobo, 2010; Wheat et al., 2003)
	Dropout from other previous academic programmes *	(Orellana et al., 2020)
	Entry time to higher education *	(Orellana et al., 2020)
	Number of subjects taken *	(Orellana et al., 2020)

Determinant	Variable	Theoretical references
	Academic behaviour, attitudes, and self-perceptions	(Nishat et al., 2020; Gildehaus et al. 2019)
	Use of university welfare programmes	(Nishat et al., 2020; Gildehaus et al. 2019)
	Communication with the HEI	(Guzmán et al., 2020)
Institutional	Attention of the HEI administrative staff *	(Orellana et al., 2020)
	Technologies used by the HEI related to the training programme	(Oliveira et al., 2018)
	Teaching role*	(Guzmán et al., 2020)
	Participation in extracurricular activities *	(Amare & Simonova, 2021)

Explanatory variables assessed.

Note: * Corresponds to variables not addressed in the literature on higher education dropout among rural students.

In relation to the reliability of the instrument, an internal consistency analysis was carried out for each of the four determinants assessed, using the Cronbach's Alpha statistic (α). In this way, α was considered moderate if its esteem was between 0.40 and 0.60, satisfactory between 0.60 and 0.80, and high when it was above 0.80 (Cronbach, 1951). Additionally, it was decided to eliminate the explanatory variable in the determinant in question if this improved the value of α. Table 11 presents the reliability of the applied questionnaire.

Table 11.
Reliability of the self-reporting questionnaire.

Determinant	Code	α	α-SE**
Individual	I1		0.580
	I2		-0.04*
	I3		-0.022*
	I4		-0.037*
	I5		-0.026*
	I6		0.015
	I7		-0.077*
	I8		-0.045*
	I9		-0.048*
	I10	-0.053*	-0.096*
	I11		-0.099*
	I12		-0.094*
	I13		-0.088*
	I14		-0.085*
	I15		-0.113*
	I16		-0.097*
	I17		-0.092*
	I18		-0.103*
	I19		-0.05*
Socio-economic	S1		0.575
	S2		0.439
	S3	0.530	0.514
	S4		0.466
	S5		0.483

Determinant	Code	α	α-SE**
	S6		0.523
	S7		0.483
	S8		0.484
	S9		0.492
	S10		0.497
	S11		0.542
	S12		0.548
	S13		0.453
	S14		0.609
	S15		0.526
	A1		0.684
	A2		0.678
	A3		0.689
	A4		0.740
	A5		0.633
	A6		0.642
	A7		0.626
	A8		0.636
Academic	A9	0.670	0.642
	A10		0.643
	A11		0.651
	A12		0.635
	A13		0.660
	A14		0.654
	A15		0.701
	A16		0.664
	A17		0.663
	IES1		0.781
	IES2		0.680
	IES3		0.677
Institutional	IES4	0.744	0.713
	IES5		0.720
	IES6		0.694
	IES7		0.698
	IES8		0.759

Note: * The value is negative due to a negative average covariance between elements. These breaches the assumptions of the reliability model, however, by removing some element this value may fit the reliability model. ** α-SE corresponds to the value of α if the element is removed.

Based on the results in Table 11 and to ensure the reliability of the questionnaire, variables that improve the value of α, were eliminated from the analysis, both for the selection of statistical tests to be used and for the analysis of the results. Thus, in the case of the individual determinant, the variable I1 was eliminated so α was considered moderate (0.58), for the socio-economic determinant S1, S11 and S14 were eliminated so α was acceptable (0.60), for the academic determinant A2, A4 and A15 were eliminated so α was acceptable (0.701), and, finally, for the institutional determinant IES1 and IES8 were eliminated so α was acceptable (0.781).

Data analysis and modelling

With the data collected, the nature of the data and due to the purpose of this study, where rural students are categorised, we proceeded to identify the variables that influence the decision to drop out or stay in higher education. For this purpose, the Mann-Whitney U test was used because the data did not fit a normal distribution (see Table 12), as well as facilitating the comparison of independent populations, in this case the students who expressed the intention to drop out or to stay in the training programme. The existence of statistically significant differences between the two groups of students, for the study variables, was presented when the p-value was less than 0.05 (Nachar, 2008).

Table 12.

Kolmogorov-Smirnov normality test.

Code	Statistic*	p-value**	Code	Statistic*	p-value**
I2	0.388	0.00	S9	0.461	0.00
I3	0.394	0.00	S10	0.369	0.00
I4	0.486	0.00	S12	0.468	0.00
I5	0.371	0.00	S13	0.179	0.00
I6	0.361	0.00	S15	0.523	0.00
I7	0.338	0.00	A1	0.489	0.00
I8	0.248	0.00	A3	0.411	0.00
I9	0.296	0.00	A5	0.240	0.00
I10	0.422	0.00	A6	0.229	0.00
I11	0.410	0.00	A7	0.242	0.00
I12	0.385	0.00	A8	0.238	0.00
I13	0.188	0.00	A9	0.238	0.00
I14	0.201	0.00	A10	0.229	0.00
I15	0.218	0.00	A11	0.253	0.00
I16	0.461	0.00	A12	0.266	0.00
I17	0.434	0.00	A13	0.228	0.00
I18	0.233	0.00	A14	0.322	0.00
I19	0.224	0.00	A16	0.272	0.00
S2	0.243	0.00	A17	0.241	0.00
S3	0.540	0.00	IES2	0.257	0.00
S4	0.472	0.00	IES3	0.326	0.00
S5	0.470	0.00	IES4	0.467	0.00
S6	0.540	0.00	IES5	0.422	0.00
S7	0.439	0.00	IES6	0.365	0.00
S8	0.474	0.00	IES7	0.403	0.00

Note: * The degrees of freedom (Df) were 269. Normal distribution is rejected with p-value < 0.05.

With the explanatory variables in which statistically significant differences were identified, it was proceeded to compare the way in which the groups behaved in relation to these variables, so the modelling based on clusters or classification was chosen, since this allows the description of groups with homogeneous characteristics based on the study variables of a particular event or phenomenon (Everitt et al., 2011). In this sense, cluster modelling assumes that individuals share a common distribution of characteristics, while different individuals will follow a different distribution (Tan et al., 2019). That is, a study population has a finite number of n distributions, and

the purpose of clustering would be to take such a mixture and analyse it into simple components and estimate the "membership probabilities"(Everitt et al., 2011).

This type of modelling has both supervised and unsupervised techniques. Since there are no previous studies in the rural population to establish how students cluster, both those who wish to drop out and those who wish to stay in higher education, hierarchical cluster modelling was used. This type of modelling, being in the unsupervised category, does not require an underlying statistical model. Ward's technique was chosen to create the model because it minimizes the sums of squares of each variable's deviations from the mean, allowing for homogenous groups of people. Furthermore, the squared Euclidean distance interval was used to determine similarities and differences across observations, and data values were normalized to minimize the impacts of the questionnaire scales.

To establish differences between clusters, the Mann-Whitney U statistic was used if the number of clusters to be extracted was two, or, if the number was greater than two, the Kruskal Wallis statistic was used. In either case, differences were considered statistically significant when the p-value was less than 0.05 (Nachar, 2008). Finally, descriptive statistics were used to identify the individual, socio-economic, academic, and institutional characteristics that influence dropout and retention among rural students.

Results

Regarding the statistically significant differences between rural students with the intention to drop out or to remain in the higher education programme, it was identified that in the case of the explanatory variables I9, I15, S15, A12, A13, A14, A16, A17, IES2, IES3, IES5, IES6 and IES7 were those in which the participants in the sample differed from each other Table 13 presents the results of the Mann-Whitney U test.

Table 13.
Mann-Whitney U-test results between students with intention to drop out and with intention to stay.

Code	Statistic	p-value**	Code	Statistic	p-value**
I2	8,577.500	0.395	S9	8,961.500	0.874
I3	8,841.500	0.717	S10	8,156.500	0.108
I4	8,399.000	0.156	S12	8,420.000	0.181
I5	8,238.500	0.145	S13	8,063.500	0.117
I6	8,308.000	0.194	S15	8,107.000	0.010
I7	8,585.500	0.432	A1	8,741.000	0.504
I8	8,056.500	0.103	A3	8,429.000	0.238
I9	7,801.500	0.038	A5	8,620.500	0.477
I10	8,692.000	0.473	A6	8,387.000	0.275
I11	8,361.000	0.171	A7	8,514.000	0.373
I12	8,775.000	0.611	A8	8,280.500	0.205
I13	8,341.500	0.260	A9	8,339.500	0.236
I14	8,102.500	0.128	A10	8,158.000	0.137
I15	6,905.000	0.001	A11	8,056.500	0.101
I16	8,246.000	0.064	A12	7,316.500	0.004
I17	8,536.500	0.283	A13	7,475.500	0.010
I18	8,715.500	0.602	A14	7,869.500	0.040
I19	8,862.000	0.773	A16	6,430.000	0.000

Code	Statistic	p-value**	Code	Statistic	p-value**
S2	8,924.500	0.850	A17	7,420.000	0.007
S3	8,932.500	0.684	IES2	7,189.500	0.002
S4	8,682.000	0.450	IES3	6,996.500	0.000
S5	9,020.000	0.968	IES4	8,232.500	0.087
S6	8,890.500	0.429	IES5	7,895.000	0.028
S7	8,848.000	0.708	IES6	6,862.000	0.000
S8	8,658.000	0.418	IES7	7,638.000	0.009

Note: * Difference of medians with p-value is accepted < 0.05.

Taking as a reference the variables in which statistically significant differences were identified, it was found that the (male) parents of students with the intention of dropping out had a lower educational level. At the same time, this group of students most frequently expressed that work and family obligations reduced the time they spent on their education. The need to move to study in a place other than the place of origin was more frequent in the group of students with the intention of dropping out. In terms of academic performance, students who indicated their intention to stay considered their academic performance to be outstanding or excellent.

In the case of academic preparation at previous levels of education, students intending to drop out most frequently stated that they were not adequately prepared for higher education. In addition, there is a higher level of dissatisfaction in the choice of training programme among this student population, as well as a lack of access to technological resources for the correct development of their training programme.

However, for the variables of the institutional determinant, students with the intention of dropping out presented greater difficulties in communication with the HEIs, as well as in attention from administrative staff. Similarly, this group of students consider that the technologies (e.g.: virtual campus, specialised software, and hardware) acquired by the institution are not necessarily the most appropriate, as they present greater dissatisfaction. The situation described above is the same in relation to their perception of the bibliographic resources (e.g.: books or databases) that HEIs have. In relation to teaching, students with the intention of dropping out presented higher levels of dissatisfaction with the attention given by teachers to doubts and concerns, as well as the way in which the contents were taught. Table 6 presents the response counts for each of the student groups.

Table 14.
Response count among students with intention to drop out and to stay.

Code	Options for response	No*	Yes**	No*	Yes**
		Count		%	
I9	Did not study	18	17	13%	13%
	Primary	56	74	41%	56%
	Secondary	31	20	22%	15%
	Technical and tecnological	8	7	6%	5%
	Professional	15	3	11%	2%
	Postgraduate	1	1	1%	1%
	Don't know	9	9	7%	7%
	Total	**138**	**131**	100%	100%
I15	Strongly disagree	22	9	16%	7%

Code	Options for response	No*	Yes**	No*	Yes**
		Count		%	
	Disagree	33	16	24%	12%
	Neither disagree nor agree	29	30	21%	23%
	Agree	36	53	26%	40%
	Strongly agree	18	23	13%	18%
	Total	**138**	**131**	100%	100%
	Yes	10	23	7%	18%
S15	No	128	108	93%	82%
	Total	**138**	**131**	100%	100%
A12	Deficient	2	0	1%	0%
	Insufficiente	3	6	2%	5%
	Acceptable	30	45	22%	34%
	Outstanding	68	63	49%	48%
	Excellent	35	17	25%	13%
	Total	**138**	**131**	100%	100%
	Strongly disagree	4	13	3%	10%
	Disagree	13	14	9%	11%
	Neither disagree nor agree	36	43	26%	33%
A13	Agree	59	43	43%	33%
	Strongly agree	26	18	19%	14%
	Total	138	131	100%	100%
A14	Strongly disagree	1	1	1%	1%
	Disagree	2	3	1%	2%
	Neither disagree nor agree	7	16	5%	12%
	Agree	46	47	33%	36%
	Strongly agree	82	64	59%	49%
	Total	138	131	100%	100%
A16	Strongly disagree	2	6	1%	5%
	Disagree	6	14	4%	11%
	Neither disagree nor agree	11	17	8%	13%
	Agree	48	59	35%	45%
	Strongly agree	71	35	51%	27%
	Total	138	131	100%	100%
A17	Strongly disagree	2	4	1%	3%
	Disagree	6	9	4%	7%
	Neither disagree nor agree	22	27	16%	21%
	Agree	48	55	35%	42%
	Strongly agree	60	36	43%	27%
	Total	138	131	100%	100%
IES2	Never	15	33	11%	25%
	Occasionally	69	64	50%	49%
	Always	54	34	39%	26%
	Total	138	131	100%	100%
IES3	Never	5	17	4%	13%
	Occasionally	49	60	36%	46%

Code	Options for response	No*	Yes**	No*	Yes**
		Count		%	
	Always	84	54	61%	41%
	Total	138	131	100%	100%
IES4	Never	1	3	1%	2%
	Occasionally	26	34	19%	26%
	Always	111	94	80%	72%
	Total	138	131	100%	100%
IES5	Never	1	4	1%	3%
	Occasionally	36	47	26%	36%
	Always	101	80	73%	61%
	Total	138	131	100%	100%
IES6	Never	1	12	1%	9%
	Occasionally	43	58	31%	44%
	Always	94	61	68%	47%
	Total	138	131	100%	100%
IES7	Never	3	9	2%	7%
	Occasionally	36	47	26%	36%
	Always	99	75	72%	57%
	Total	138	131	100%	100%

Note: * No, these are students who intend to stay. ** Yes, these are students with the intention to drop out. The variable codes are presented in Supplementary 10.

Dropout in rural higher education.

With the explanatory variables for dropout and permanence in which statistically significant differences were identified, for the study population that reported wanting to drop out, we proceeded to the development of the cluster-based model. Thus, the total of 131 cases that made up the sample section were validated for the development of the hierarchical cluster. The cut-off was made at the rescaled distance 20 (see Figure 12) thus forming two clusters. The first with n = 45 (CD1) and the second with n = 86 (CD2).

In the case of both clusters, they were characterised by low levels of the parents' education. Thus, for CD1, 20% of its members reported that their father had no education at all, 62.2% had completed primary school, 11.1% had completed secondary school and only 2.2% had completed their undergraduate degree. For CD2 members indicated that 9.3% had not completed any level of education, 53.5% had completed primary school, 17.4% had completed secondary school and 9.3% had completed an undergraduate degree, while 10.5% indicated that they did not know their own father.

Regarding statistically significant differences between clusters, the results of the Mann-Whitney U test are presented in Table 15. Differences were identified in the explanatory variables I9, I15, S15, A14, A16, IES2, IES3, IES4, IES5, IES6 and IES7.

In the case of both clusters, they were characterised by low levels of the parents' education. Thus, for CD1, 20% of its members reported that their father had no education at all, 62.2% had completed primary school, 11.1% had completed secondary school and only 2.2% had completed their undergraduate degree. For CD2 members indicated that 9.3% had not completed any level of education, 53.5% had completed primary school, 17.4% had completed secondary school and 9.3%

had completed an undergraduate degree, while 10.5% indicated that they did not know their own father.
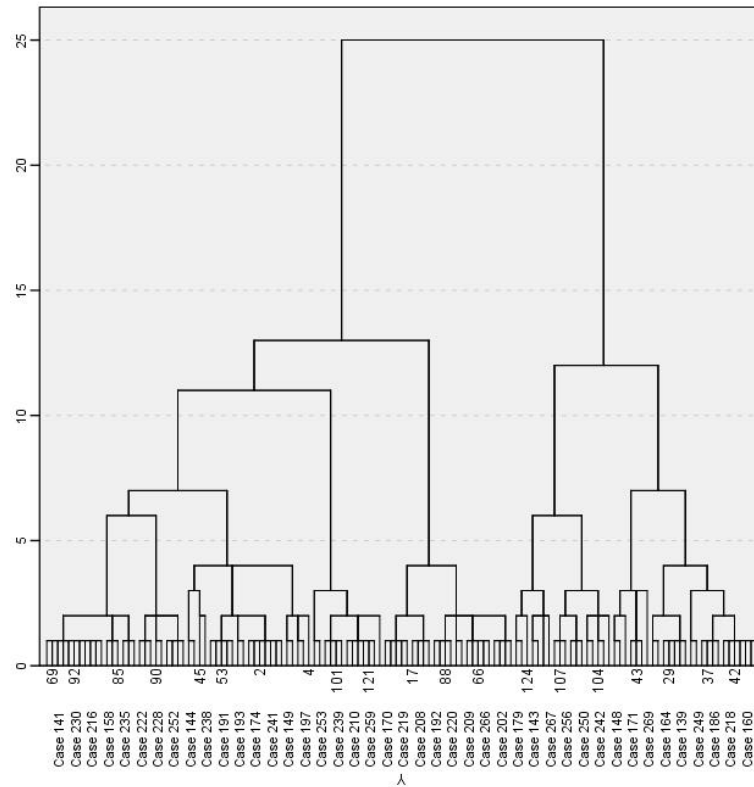

Figure 15. Dendrogram.
Note: The X-axis represents the cases of students with intention to drop out, and the y-axis represents the combination of rescaled distance clusters.

Table 15.
Mann-Whitney U test results for CD1 and CD2.

Code	Statistic	p-value*
I9	1,429.500	0.007
I15	1,419.000	0.009
S15	1,208.000	0.000
A12	1,769.000	0.382
A13	1,850.500	0.670
A14	1,175.000	0.000
A16	1,444.000	0.011
A17	1,724.000	0.280
IES2	1,139.000	0.000
IES3	1,135.000	0.000
IES4	7,3.500	0.000
IES5	899.000	0.000
IES6	686.000	0.000
IES7	1,429.500	0.007

Note: * Difference of medians with p-value < 0.05 is accepted.

Regarding work obligations, for CD1, 68.9% stated that these interfere with their educational process, while for CD2 the percentage was lower at 52.3%. In relation to the need to move from their place of origin to another city or municipality to be able to study, 42.2% of CD1 indicated having to do so. On the other hand, only 4.7% of CD2 students reported this situation. In the case of satisfaction with the choice of the training programme, 66.7% of students in CD1 said they were satisfied, while 94.2% of students in CD2 said they were satisfied with their choice of training programme Concerning the availability of the necessary tools to carry out the work left in class (e.g.: computer, internet, computer programs), 44.4% of the students in CD1 indicated that they did not have them and for CD2 it was only 9.3%.

However, regarding the evaluation of the communication processes with HEIs, 88.9% of DC1 and 66.3% of DC2 indicated that it was not easy to communicate with the HEIs. In line with the above, 82.2% of CD1 members perceive that HEI officials do not attend to their needs, and 46.5% of CD2 members perceive that HEI officials do not attend to their needs. In terms of the tools (e.g.: databases, software, etc.) available to HEIs, 77.8% (CD1) and 18.6% (CD2) of students consider that these are not adequate. In relation to the training process, CD1 members tend to have perceptions that teachers do not deal with their doubts in a timely manner (84.4%), as well as that they do not impart the content in a simple way (82.2%). In these same aspects for CD2, 37.2% reported that teachers do not address their doubts, while 42.2% felt that they did not impart the content in a simple way.

Permanence in rural higher education.

In relation to the students who indicated that they wanted to remain in the undergraduate programmes, it was identified that they conglomerate into two clusters (cut-off at the rescaled distance 20). Thus, the first cluster consisted of n = 99 (CP1) and the second of n = 39 (CP2). Figure 16 presents the dendrogram.

Regarding the statistically significant differences between clusters, Table 16 presents the results of the Mann-Whitney U test, differences were identified in the explanatory variablesA12, A13, A14, A16, IES2, IES3, IES4, IES5, IES6 and IES7.

In relation to the differences identified, 71.7% of the related students in CP1 indicated that they considered their GPA to be outstanding or excellent, while for CP2 it was 82.1%. Regarding the perception of the students' preparation for entry to higher education, 65.7% of CP1 stated that their teachers had prepared them adequately. In the case of CP2, only 52.3% considered that their teachers had prepared them adequately for entry to HEI. At the same time, CP1 students reported being satisfied with the choice of the training programme in which they are enrolled, while for CP2 only 74.4% were satisfied with the training programme. Finally, 81.8% of CP1 and 69.2% of CP2 considered that they carry out their training activities on time.

However, in the case of the institutional explanatory variables, 49.5% of CP1 and 89.7% of CP2 stated that it was never or occasionally easy to communicate with the HEI. Consequently, 74.4% of CP2 stated that HEI administrative staff never or occasionally attend to their requests. On the other hand, 74.1% of CP1 assessed that the administrative staff of the HEIs did attend to their requests and concerns. As for the technologies (e.g.: virtual campus, specialised software, and hardware) used by the HEI where they are studying, 90.9% of CP1 and 53.8% of CP2 considered them adequate.

Regarding the bibliographic resources (e.g.: books or databases) held by HEIs, 88.9% of CP1 members considered them to be relevant for the development of their academic activities, while for CP2 (66.7%) they did not consider them to be appropriate. Finally, regarding institutional processes related to teachers, 89.9% of CP1 and 12.8% of CP2 reported that teachers dealt with their doubts and concerns in a timely manner. Something similar happens with the way in which teachers teach the contents of the subjects where the perception of 89.9% of the members of CP1 was positive in this aspect, however, for CP2 only 25.6% agreed with it.
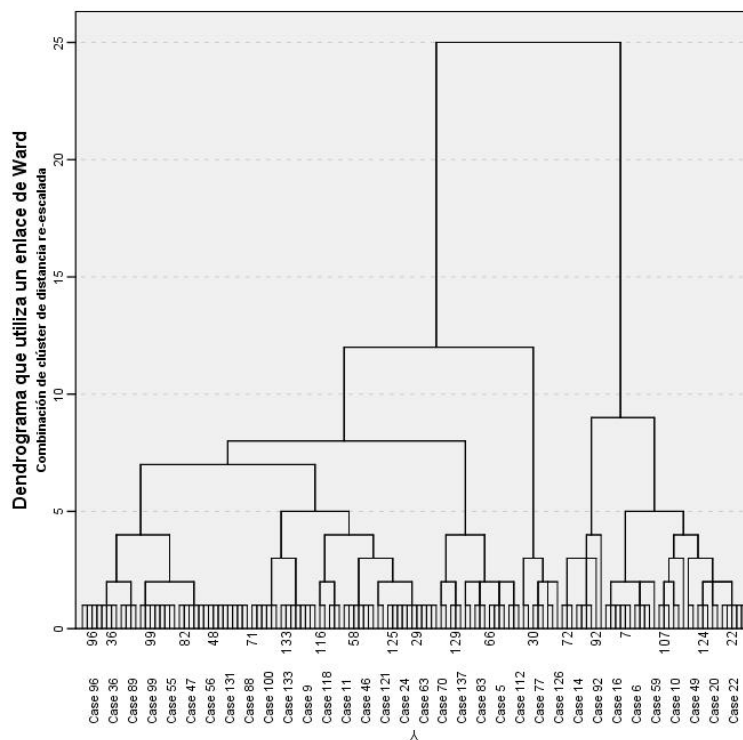
Figure 16. Dendrogram.
Note: The X-axis represents the cases of students with intention to drop out, and the y-axis represents the combination of rescaled distance clusters.

Table 16. Mann-Whitney U test results for CP1 and CP2.

Code	Statistic	p-value*
I9	1.827.000	0,609
I15	1.704.500	0,274
S15	1.873.500	0,548
A12	1.536.500	0,044
A13	1.449.000	0,016
A14	1.206.500	0,000
A16	1.547.000	0,045
A17	1.563.500	0,063
IES2	912.000	0,000
IES3	920.000	0,000

IES4	1.210.500	0,000
IES5	852.500	0,000
IES6	437.500	0,000
IES7	675.000	0,000

Mann-Whitney U test results for CP1 and CP2.
Note: * Difference of medians is accepted with p-value < 0.05.

Discussion and conclusions

As presented in the results section, it was found that student permanence and dropout in the rural population is influenced by different explanatory variables. Thus, the findings of the present study concerning the individual determinant identified, firstly, that dropout is related to the educational level of the father, which is a discrepancy with previous studies such as those of Guzmán et al. (2020b), Barbosa-Camargo et al. (2021) and Lundetræ (2011), because dropout is usually related to the educational level of the mother. This may be the result of the influence of other variables not evaluated in the present study, such as the cultural factors of these populations, or the low penetration of this gender in the educational system (Radiowala & S. Molwane, 2021). And, secondly, that work, and family obligations make it difficult for rural students to remain in the education system, which is consistent with the study by De Hart and Vender (2013) who reported the relevance of this variable as a predictor of dropout in the rural student population.

In the case of the socio-economic determinant, it was established that there are no statistically significant differences in variables (type of housing, socio-economic stratum, access to public services, being a beneficiary of state subsidies, income level and financing of studies) that are traditionally conclusive in the dropout or permanence of other types of students, such as urban students (Segovia-García et al., 2022; Byun et al., 2012). In view of the above, it was found that students with the intention of dropping out most frequently expressed the need to move from their place of residence to pursue their education.

For the academic determinant variables, it was established that permanence in higher education is related to education at previous levels, coinciding with the studies of Choi and Park (2018). Similarly, the satisfaction of rural students with the training programme is a deterrent to the intention to drop out. Unlike the study developed by Guzmán et al. (2021b) for a rural student population in undergraduate programmes in virtual mode, in the present study, by linking the face-to-face mode, it was observed that the academic variables do have an impact on the events of desertion and permanence. Finally, in the explanatory variables of the institutional determinant only, no statistically significant differences were detected between the typology of students in relation to institutional welfare plans and extracurricular activities. The above is contrary to the results presented by Warner (1993) and Nishat et al. (2020).

With regard to the internal comparison between the groups of students (with the intention of leaving or remaining) it was determined that in the case of CD1 this is associated with lower educational levels of the father, greater interference of work and family obligations with the study and lower evaluations with regard to having tools for the development of their work, satisfaction with the training programme, the ease of communication and attention with the HEI, the technologies and resources provided by the institutions, the attention of the teachers and the simplicity of teaching the classes. For CD2, the main associated characteristic was the need to move from their place of origin to pursue their studies. However, in the case of permanence, when analysing the clusters, it was identified that there is no incidence of individual and socio-economic

variables in this event, contrary to the findings of Georg (2009) and Ministry of National Education of Colombia (2009). CP1 was characterised by higher self-perceptions in relation to institutional variables, while CP2 was characterised by higher self-perceptions in relation to academic variables.

In light of what has been stated, it should be noted that the present study provided new insights into the events of dropout and retention in higher education for rural students by addressing variables that had not been previously addressed such as marital status, type of housing, access to public services, state benefits, methods of financing their studies, dropout in other previous academic programmes, time of entry to higher education, number of subjects taken, attention from HEI administrative staff, the role of the teacher and extracurricular activities. The findings provide an opportunity for academics to further study these events and for public and institutional policy makers to modify current policies and create new ones in order to mitigate and prevent students' dropout and consolidate their permanence at the educational level.

As a result of what has been described, it is necessary to recognise that policies that transcends over time are needed with the aim of ensuring educational quality and reducing dropout indicators and increasing permanence rates in the rural student population. Considering that some of the variables that must be addressed for this purpose are not modifiable in the short or medium term, the State efforts are required to improve the educational levels of parents, reduce the pressure of family and work obligations on students, improve academic performance prior to higher education, support HEIs in adapting education to rural areas, especially when ICTs are not adequate for this student population, among other factors.

However, for future research, some limitations of the methodological structure must be overcome, such as the transversality of the chapter, the sample size of the analysis groups, among others. In addition, the results of the study must be interpreted from the limitations of the statistical analyses developed and the modelling technique selected, considering that all the variables analysed have the potential to explain dropout or retention in rural students studying in higher education, however, the variables that showed statistically significant differences are catalysts of these educational events. Finally, some of the findings presented here require further study, such as the limited influence of individual, socio-economic and academic variables on dropout or retention in rural higher education, hence it is imperative to establish and deepen the causes of this absence.

Supplementary material
Supplementary 10.
Self-report questionnaire.

Code	Question	Options for response
I1	Year of birth	
I2	Which is your gender?	a. Female. b. Male. c. Intersex. d. I prefer not to report.
I3	At present, do you?	a. Work full-time (48 hours). b. Work part-time (from 20 to 24 hours). c. Occasionally work (from 1 to 19 hours). d. You are unemployed. e. You do not have the need to work.
I4	Are you primarily responsible for your household expenses?	a. Yes. b. No.
I5	Do you have children under the age of 18?	a. Yes. b. No.
I6	Are you the person responsible for the upbringing of your children?	a. Yes. b. No. c. Not applicable (Only if you answered no to question 5).
I7	Which is your marital status?	a. Single (includes widowed, widower, divorced or separated). b. Married. c. In a common-law or de facto marital union.
I8	What is the highest level of education achieved by your mother?	a. She did not study. b. Primary school. c. High School. d. Technical and technological. e. Vocational. f. Posgraduate. g. You had no relationship with your mother.
I9	What is the highest level of education achieved by your father?	a. He did not study. b. Primary school c. High School. d. Technical and technological. e. Vocational. f. Postgraduate g. You had no relationship with your father

In the following, a series of statements will be presented for you to indicate the degree of agreement with each of them as to whether they adequately describe your usual behaviours, attitudes, and self-perceptions. Please answer on a scale of 1 to 5 if you think the statement describes you correctly, where 1 is "strongly disagree" and 5 is "strongly agree".

Code	Question	Options for response
I10	I like studying	a. Strongly disagree
I11	I feel that I am qualified to study at higher education level.	b. Disagree c. Neither disagree nor agree
I12	I am a responsible person for the execution of academic work independently.	d. Agree e. Strongly agree

Code	Question	Options for response
I13	I am frequently stressed by studying.	
I14	I feel that my family constantly interferes with my studies.	
I15	I feel that work or family obligations diminish the time I must devote to studying.	
I16	I am committed to the goal of completing my training programme.	
I17	I feel motivated to learn new concepts, themes, and methodologies.	
I18	I am afraid of failing in a job, assignment, and training programme.	
I19	I tend to procrastinate (leave everything to the last minute) in my daily activities including my study.	
S1	The dwelling in which you live is.	a. Owned (you are the owner). b. Familiar (someone in your family owns it). c. Leased. d. Other type, which?
S2	The house is in the stratum.	a. 1 b. 2 c. 3 d. 4 e. 5 f. 6 g. Don't know.
S3 – S11	The dwelling currently has access to the following services (multiple choice).	a. Water. b. Sewerage. c. Garbage collection. d. Electricity. e. Natural Gas. f. Internet. g. Landline. h. Pay-TV service (satellite dish, cable, satellite, etc.).
S12	Do you currently receive any benefits (e.g.: education, health, and transport) for being registered in SISBEN?	a. Yes b. No c. Don't know.
S13	Does your family receive any state subsidy (*Familias en Acción, Ingreso Seguro, Plan de Apoyo a la Vejez, etc.*)?	a. Yes b. No c. Don't know.
S14	Your family's income is between?	a. $0 to $500.000 pesos. b. $500.001 to $1.000.000 pesos. c. $1.000.001 to $1.500.000 pesos. d. $1.500.001 to $2.000.000 pesos. e. $2.000.001 to $2.500.000 pesos f. $2.500.000 pesos or more.
S15	Are your studies mainly funded by?	a. My income. b. Parents.

Code	Question	Options for response
		c. Relatives other than parents (e.g.: siblings, spouse, etc.)
		d. Scholarships given by the Higher Education Institution or University.
		e. Bank credit.
		f. ICETEX Credit.
		g. State programmes (e.g.: ser pilo paga or generación E).
		h. The university or Higher Education Institution is public and has no tuition fees.
		i. Other source of funding, Which?
S16	Do you have to commute from your place of origin to another city to be able to study?	a. Yes. b. No.
A1	The school from which you graduated from secondary or high school was.	a. Official or public. b. Private.
A2	Prior to entering the training programme (technical, technological, or vocational), obtained information (e.g.: curriculum, funding, programme costs) to make the decision to enrol.	a. Yes. b. No.
A3	Between the enrolment to the undergraduate training programme (technical, technological, or vocational) and the completion of their secondary school or high school they passed.	a. Less than 6 months. b. From 6 monts to a year. c. From 1 to 2 years. d. From 2 to 3 years. e. More than 3 years.
A4	How many subjects do you take on average per academic semester?	a. 1 b. 2 c. 3 d. 4 e. 5 f. 6 g. 7 h. 8 i. More than eight.

In the following, a series of statements will be presented for you to indicate which one describes adequately your usual behaviours, attitudes, and self-perceptions. Please answer on a scale of 1 to 5 where 1 is "Deficient" and 5 is "Excellent".

Code	Question	Options for response
A5	Your performance during the high school was:	
A6	Your performance in the subject of Maths during the high school was:	a. Deficient
A7	Your performance in the subjects of Natural Sciences during the high school was:	b. Insufficiente c. Acceptable
A8	Your performance in the subject of Chemestry during the high school was:	d. Outstanding e. Excellent
A9	Your performance in the subjects of Human Sciences (History, Geography,	

Code	Question	Options for response
	Philosophy, etc.) during the high school was:	
A10	Your performance in the subject of Spanish during the high school was:	
A11	Your performance in the subject of English during the high school was: Consider that your academic performance (average) during the time you have been linked to the Higher Education Institution or university has been.	

In the following, a series of statements will be presented for you to indicate the degree of agreement with each of them as to whether they adequately describe your usual behaviours, attitudes, and self-perceptions. Please answer on a scale of 1 to 5 if you think the statement describes you correctly, where 1 is "strongly disagree" and 5 is "strongly agree".

Code	Question	Options for response
A12	Your teachers have prepared you well for university.	a. Strongly disagree b. Disagree
A13	Your choice of undergraduate programme has satisfied you.	c. Neither disagree nor agree d. Agree
A14	The teachers in your degree programme often leave a lot of work.	e. Strongly agree
A15	You have the necessary tools to do the work left in class (e.g.: computer, internet, software).	
A16	You hand in work left by the teacher on time.	
IES1	How often you made use of tutoring, psychological counselling, nutritional benefits, and other programmes offered by your Higher Education Institution or University.	a. Never. b. Occasionally. c. Always.
IES2	You considered that it was easy to communicate with the HEI/University through the channels defined by the HEI/University.	
IES3	The administrative staff of the Higher Education Institution or University attended to their requirements.	
IES4	The technologies (e.g.: virtual campus, specialised software, and hardware) used by the HEI or University were adequate for their training process.	
IES5	The bibliographic resources (e.g.: books or databases) owned by the HEI or university were relevant to the development of its academic activities.	
IES6	Teachers tended to address their doubts and concerns in a timely manner.	
IES7	Teachers taught the content of the subject in a simple way.	

Code	Question	Options for response
IES8	You were involved in extra-curricular activities such as dance, sports, music, etc.	

Chapter Six: Dropout in Rural Higher Education: Analysis of Causes from Systemic Thinking

Finally, this chapter takes up the findings of the previous chapters to establish causality between the variables that explain dropout in rural higher education, using systems thinking, more specifically, through modelling based on causal loops. For this chapter, the in-depth interview was used to establish the relationships between the variables.

Abstract

Dropout limits the personal and social benefits of education. In this sense, states and educational institutions seek to prevent and mitigate this phenomenon through the development of public and institutional policies, however, the complexity of the phenomenon is such that these policies are insufficient and are not fully articulated with the realities of students, hence the persistence of high dropout rates. Thus, the objective of this chapter was to establish the causes of student dropout in rural higher education using a conceptual model based on systems thinking. A qualitative study was carried out with the participation of 19 students. The analysis was carried out using open coding to identify the variables that had an impact on this educational phenomenon and was completed with a model based on a causal loop diagram. The results showed that work and family obligations, the student's financial condition and the role of teachers are the most recurrent variables in the participants. Finally, based on the variables found and the model, actions are proposed that should be incorporated into the framework of public and institutional policies to prevent and mitigate the dropout phenomenon.

Introduction

Dropout as an educational phenomenon limits the personal and social benefits of education, such as: improvement of the population's income, increase in productivity, strengthening of democratic processes, reduction of violence and insecurity, among others (Guzmán et al., 2021a; Cristia & Pulido, 2020; Chalfin & Deza, 2019; Lance, 2011). In this sense, this phenomenon is present throughout the various levels that make up the education system, although it is more evident in what is known as higher or tertiary education (Segovia-García et al., 2021; Barbosa-Camargo et al., 2021; Chung & Lee, 2019). In this context, the states have sought to implement public policies in conjunction with Higher Education Institutions (HEIs) to prevent and mitigate dropout at this level of education, where the personal and social benefits of education are maximised (Guzmán et al., 2021b; Palacio et al., 2020; McMahon, 2010).

Within the framework of the public policies implemented, it has become evident that high dropout rates persist, as in the case of the countries that make up the Organisation for Economic Co-operation and Development, where the average rate of this phenomenon before COVID-19 was 64.5% ([OECD], 2018), or, in the case of Latin America where this rate was close to 54% (Becerra et al., 2019), and as a result of the COVID-19 pandemic, the Economic Commission for Latin America and the Caribbean ([ECLAC], 2021) estimated that this rate will increase to 57.9%.

In this scenario, it can be seen that current public policies are not efficient in preventing and mitigating dropout. This is due to a certain extent to the lack of articulation between policies and the causes that lead students to end their training process early (Guzmán et al., 2021c; Améstica-Rivas et al., 2020; Adrogue & García, 2018). An example of this is: first, the economic reductionism in which the states have fallen into, by asserting that the main cause of dropout is the financial problems of the family and the student, thus ignoring the fact that there are other individual, social and economic, academic and institutional variables that lead to dropout at the higher level, and that

are documented in the literature (ej.: Vooren et al., 2022; Guzmán et al., 2021a; Guzmán et al., 2021b; Behr et al., 2020; Li & Carrol, 2020; Barragán & González, 2017). Secondly, the partial or complete delegation of responsibility for the mitigation and prevention of dropout in higher education to HEIs, where they have a limited scope for the treatment of some variables such as: the financing of training programmes, low family income, the low social capital achieved by the student, the age of entry to the educational level, among others (Barragán & Lozano, 2022).

This disarticulation is exacerbated regarding higher education in rural areas for two reasons. The first one concerns the decontextualization of public policies in relation to the social realities experienced in these areas (Guzmán et al., 2021b), such as the lack of access to technological resources, violence, drug trafficking, high levels of poverty and the value given to education by families, among others; and the second reason is related to the lack of interest of both the state and the academic community in the study of dropout in higher education in rural populations (2021a), in which, by means of a systematised review, they only found 21 research studies in the SCOPUS bibliographic database between 1990 and 2020 on dropout at the educational level for rural populations, which is much lower than studies of this phenomenon developed in other contexts.

Having said that, more research is needed on the causes that lead rural students to end their education early, especially when most studies have been conducted in countries where social disparities are not as marked (e.g.: Troester-Trate, 2020; Castleman & Meyer, 2020; Hines et al., 2015; Byun et al., 2015) and not in contexts with social disparities as marked as those in developing countries. (Guzmán et al., 2010a; Guzmán et al., 2021c; Rueda et al., 2020).

Thus, the aim of this article was to establish the causes of student dropout in rural higher education using a conceptual model based on systems thinking. The geographical delimitation of the study was reduced to Colombia, due to the fact that historically the rural areas of the country have been characterised by violence and conflict by various armed groups, which have led to marginalisation, inequality in the income of the population, regional differences and various social tensions (Guzmán et al., 2021b), this makes it possible to identify and understand new causes of dropout that have not been previously documented, thus broadening the scope of the field of study and the information available for the development of public and institutional policies in line with rural populations.

This article is divided into four sections. The first one corresponds to the theoretical framework, background, and research questions; the second one presents the methodology used in the research; the third one presents the results in which the model based on systems thinking is shown and developed; and the fourth one presents the conclusions and final considerations.

Theoretical framework and background
Dropout as a complex phenomenon
Dropout does not have a single meaning, but is strongly influenced by the various academic, political, and social actors who analyse and study it (Barragán & Lozano, 2022; Guzmán et al., 2021b). The definitions can be of an operational nature, developed by states to quantify the effects of the phenomenon, or they can be of an academic nature. This article falls into the latter typology, more specifically, that given by the ALFA GUIDE Project. Thus, this phenomenon is defined as:

> The discontinuation of the relationship between the student and the training programme leading to a higher education qualification before the qualification is achieved. A complex, multidimensional and systemic event, which can be understood as cause or effect, failure or reorientation of a learning

process, compulsory choice or response, or as an indicator of the quality of the education system (ALFA GUIDE Project, 2013, p.6).

Within the framework of the complexity, multidimensionality and systematicity described in the definition of Project ALFA GUIDE, the study of this phenomenon has been characterised as multidisciplinary (Xavier & Meneses, 2020). This is evident in the analyses developed from the sociological, interactionist, organisational, psychological, and economic approaches, which have resulted in the study of multiple explanatory variables intrinsic and extrinsic to the student that allow us to establish the causes that lead them to drop out. These explanatory variables have been grouped into four determinants: individual, social, and economic, academic, and institutional. This categorisation has been used extensively in previous studies such as those by Barragán and Lozano (2022), Guzmán et al. (2021a), Guzmán et al. (2021b), Segovia-García et al. (2022), Segovia-García and Said-Hung (2021), Arias-Velandia et al. (2018), Fonseca and García (2016), as well as Donoso and Schiefelbein (2007).

Thus, the individual determinant is conceptualised as the characteristics associated with the student that directly influence the decision to drop out. The social and economic determinant refers to the socio-economic variables that affect the student and his/her family and that directly or indirectly influence the student's decision to drop out. The academic focuses on learning outcomes, competence development, student performance and other factors that influence the teaching and learning process at all levels of education. Finally, the institutional one explains those characteristics of HEIs that allow for the proper development of the educational process.

From the determinants described above, the complexity of the dropout phenomenon arises, since the explanatory variables of one determinant have the capacity to influence both positively and negatively the variables of another (Guzmán et al., 2021a), Therefore, both states and HEIs, by trying to modify one variable of a determinant, may generate a collateral effect on another, which may lead students to drop out and, consequently, exacerbate the social disparities experienced in rural areas. Similarly, the complexity of this phenomenon stems in part from the number of actors and different levels of decision-making involved in its prevention and mitigation.

Background to dropout in rural higher education

As noted in the introduction, dropout in higher education in the rural student population has not been widely debated by the academic community; however, there are multiple findings in relation to the four determinants and variables that explain this phenomenon.

In the case of the individual determinant, it has been found that women are more likely to drop out of higher education due to domestic and child-rearing obligations (De Hart & Venter, 2013), while for men, dropout is related to work obligations or receiving material in a second language (De Hart & Venter, 2013). In turn, older and unemployed students tend to drop out more frequently due to the need to provide basic household goods and services (Nishat et al., 2020; De Hart & Venter, 2013). In addition, the competition between working hours and study hours leads rural students to underperform academically, resulting in the decision to drop out of school (Pillay & Ngcobo, 2010).

However, the academic support structures, especially the educational level of the parents, are significantly related to the student's intention to continue their educational process (Guzmán et al., 2021b; De Hart & Venter, 2013). Thus, Bania and Kvernmo (2016) found that women are more likely to continue their educational process the higher the educational level of their parents. On the

other hand, belonging to an ethnic group and the design of academic material in native languages help to mitigate dropout due to a lack of understanding of the material (De Hart & Venter, 2013). On the other hand, Castelman and Meyer (2020) in their research found that rural students have several difficulties in adapting to HEIs.

Other individual determinant variables that influence dropout in the rural student population include: the type of family (Rueda et al., 2020), the pressure and stress derived from the social context and from entering HEIs (Pillay & Ngcobo, 2010), the lack of autonomy of the student in the development of academic activities (Meisalo et al., 2002), among others.

However, in the case of the social and economic determinant, the financial vulnerability of rural populations is a predictor of the intention to drop out (Castelman & Meyer, 2020) due to work and personal obligations and high expenses associated with study (Rueda et al., 2020). Also, because of poverty, students are forced to take full-time or part-time jobs, increasing the likelihood of dropping out of school (Muñoz, 2013; De Hart & Vent, 2013). On the other hand, the low income of rural families affects the student experience in HEIs by restricting participation in both classroom and institutional activities that involve high costs, leading to frustration as well as poor academic performance (Hines et al., 2015). In addition, the literature shows that difficulties in finding accommodation (Pillay & Ngcobo, 2010), long commuting times between housing and HEIs (Troester-Trate, 2020) and inefficient state support (Rashid & Sarker, 2008) led to the phenomenon of dropout.

In relation to the academic determinant, low performance in previous levels is related to performance in higher education, hence, students with better initial academic capital are less likely to drop out (Bania & Kvernmo, 2016; Rapley et al., 2008). Likewise, students who demonstrate disciplinary knowledge acquired prior to entering higher education tend to have better academic averages (Meisalo et al., 2003). On the other hand, the social capital acquired by rural students through their family and relatives is low (Castleman & Meyer, 2020), because many of the students entering education are part of the first generation of their family in an HEI. This is reflected in aspects such as the absence of a rigid support structure (Castleman & Meyer, 2020; Hines et al., 2015), fragile motivational aspects (Hines et al., 2015) and low academic average (Lewine et al., 2019).

Other explanatory variables related to this determinant are: satisfaction with the choice in the programme of study (Nishat et al., 2020; Pillay y Ngcobo, 2010), the amount of information about the chosen programme that the student knew before joining the HEI (Pillay & Ngcobo, 2010), the lack of access to technologies for the correct development of the study programme (Pérez et al., 2019; Meisalo et al., 2002), the type of school from which the student graduated (Wheat et al., 2003) and the incompatibility of timetables (Rueda et al., 2020).

Finally, in the case of the institutional determinant, the Permanence and Timely Graduation Programmes (PyGO), as the main strategy developed by the HEIs, have enabled rural students to strengthen their self-learning and autonomy skills to carry out their training process and thus avoid dropout (Warner, 1993). Similarly, the linking of the student to this type of programme significantly improves the student's academic average (Nishat et al., 2020). In the case of the development of other types of programmes by HEIs for rural students, such as those that subsidise food, it was evident from the work of Troester-Trate (2020) that they did not have an impact on the permanence.

On the other hand, the design of tools for student academic monitoring, such as Early Warning Systems (SAT in Spanish), are efficient in identifying those who intend to drop out (Oliveira et al., 2018). In terms of communication, weaknesses in the process of communicating on the part of both teaching and administrative staff are catalysts for the decision to abandon their academic training. (Guzmán et al., 2021c; Guzmán & Canovas-Rodríguez, 2020). Finally, language becomes a barrier to students' learning because in many cases course content is not designed in the native languages of these populations (Rashid & Sarker, 2008).

Research questions

Based on the objective of this article, the geographic delimitation, the theoretical framework and the research background, the following questions were proposed to guide the study presented here:

1. What variables influence dropout in the rural student population enrolled in undergraduate programmes in Colombia?
2. What are the causes that lead rural Colombian students to drop out of their undergraduate programmes?

Methodology

Design

In order to fulfil the objective of this article and answer the research questions, a qualitative study was carried out using a phenomenological approach. This approach, in the words of Fuster, allows us to base "the experiences of life, with respect to an event, from the perspective of the subject" (2019, p. 202). Thus, the development of studies from phenomenology aims to explain the nature (causes) of things, the essence and veracity of the phenomena (Husserl, 1998), in this case on rural student dropout in higher education. Now, the use of this approach in education "seeks invariant aspects, which lead it to generalise and discover the essence of social education" (Fermoso, 1989, p.120).

Participants and context

For the development of the study, rural students with the intention of dropping out or dropping out of undergraduate training programmes, whether in distance, virtual or face-to-face mode, were involved. Nineteen students from rural municipalities located in the departments of Antioquia, Bolívar, Cundinamarca, Caquetá, Nariño, Guajira, and Chocó participated. In order to anonymise their responses, they were labelled with Pi with i:1, 2,…, 19.

Data collection and tools

A semi-structured interview was used for data collection. The design and development of the script was aimed at asking about the four determinants of dropout in an indirect and direct way. The script was validated by two evaluators to check the relevance of the questions. Table 17 shows the items evaluated.

Table 17.
Basic questions for semi-structured interview.

Code	Item
1	Based on your experience, what do you gain from studying?
2	Have you attended a higher education training programme before?

Code	Item
3	What was the reason you chose to study your degree?
4	Think about your day-to-day life at university - what is the most difficult thing about studying?
5	Do you often have problems accessing content, resources or connecting to university platforms?
6	What kind of problems do you frequently face?
7	How do you rate your relationships with classmates and teachers?
8	Have you ever felt a sense of loneliness when facing your day-to-day life at university?
9	If you decided to drop out or abandon the programme you are studying, what would be the main reasons that would lead you to do so?
10	From your experience, what would institutions have to improve in order to avoid drop-out?

Note: as a recommendation of the peers, the term "university" was used, as it is more colloquial than Higher Education Institution or HEI..

The application of the script was carried out via telephone, ensuring that each of the participants' calls was recorded.

Análisis de datos

Data Analysis

The data collected was then analysed. Thus, to answer the first research question, a first phase was established, in which an open coding of the interview responses was carried out, with the aim of establishing which variables explain dropout in rural higher education. To this end, each of these was transcribed into RTF text format for subsequent processing in the AtlasTI software. The open coding of the variables was carried out using the parameters established by Flick (2012). The information was synthesised inductively, the narratives of students intending to drop out and dropouts were placed textually in the document, so there may be errors of coherence and cohesion in this first section, which are not intentional on the part of the authors of this article.

In the case of the second research question and as a second phase, we opted for the design of a qualitative model that would allow us to understand the complexity and causality of the dropout phenomenon, hence the use of systems thinking, and more specifically the Causal Loop Diagram (CLD). This type of diagram is a tool that allows for the representation of the feedback structure of the system (Stearman, 2001), achieving:

1. Rapidly capture the behaviour of the system based on the dynamic hypotheses proposed, by establishing the causes of a phenomenon.

2. Show the researcher's underlying mental model because of the research exercise.

3. Communicate the importance of feedback in the study problem.

The definition of the feedback and balance loops of the dropout phenomenon was carried out in accordance with the procedure defined by Richardson and Pugh (1981):

1. The naming of the variables involved in the system.

2. Determining the effects between variables from the narratives of study participants.

3. The classification of causal loops into Feedback (R) or Balance (B).

4. Verifying causal loops between narratives and previous research.

Finally, the computational work on the model was developed in the Stella Architect software in its version 1.9.5.

Results

The results of the analysis of the data from each of the phases described in the methodology are presented below.

Phase One

In relation to the explanatory variables for dropout identified through the in-depth interviews, it was found in relation to the individual determinant that rural students have difficulties in terms of self-management of learning, as they reported that:

P1: "The most difficult thing for me is to have a constant rhythm to study ... and the search for information because I usually feel that the teachers do not solve my doubts".

P12: "I have studied both face-to-face and online, I think the online mode requires me to be self-taught and very independent, sometimes I felt lonely and that's why I didn't continue".

In turn, the lack of motivation to study in the case of P4 and P6 was a catalyst for the intention to drop out.

P4: "I feel unmotivated to study, I feel that I am not fulfilled".

P11: "… Sometimes you say I don't want to study alone... I would like to work with my classmates, but, I mean, they don't live in the same area, you know what I mean, that discourages me".

Similarly, family and work obligations led students to drop out, given that:

P3: "I have a family and I really didn't have time to study".

P7: "With children or work it is a bit complicated for us, to say I am moving from one city to another to go to university".

P9: "I dropped out of university because I had no free time to study, my work absorbed me".

P14: "… then a family member got sick, and I had to pay for the expenses, and I had no money to continue my studies".

P2 revealed having external pressures (could be work or family, he does not specify) that led him to leave his education unfinished:

P2: "I had already taken a virtual course, but I had to withdraw because of the pressure I was under …".

In turn, for P19, the late transition to higher education led him not to continue with his undergraduate programme, as he said:

P19: "the most difficult thing... was that I hadn't studied for a long time and adapting to the rhythm of study again is very difficult".

In the case of the social and economic determinant variables, it was found that rural students had financial difficulties, so that they had to pay for their education:

P2: "If you drop out, it's because of the economy, because you can't afford to pay for it".

P9: "Well, the lack of money... no, from my point of view, for me it would be the lack of money because in my case I have had problems with my husband because he says that I come from work, and I start to study".

P10: "Sometimes, the lack of employment, I'm in an isolated region where the income is less than the minimum wage, so people live on 200,000, 300,000 pesos and it's difficult to pay for university... the truth is that it's very difficult to pay for university".

P13: "I was in the process of not continuing the programme because I was struggling to pay ... I didn't have a job and it was getting difficult for me".

P16: "I would think that economic reasons would be the first, that would be my main reason for deserting, because right now, for example, in this pandemic situation, there are many of us who have lost our jobs or who do not have the same salary we were earning, so at this time it would be the main reason why many of us are considering abandoning our jobs".

P17: "… studying at university is very expensive, and those that are not expensive are far from where I live" and "one of the main reasons for dropping out is not having a job".

P18: "I am of the opinion that the big loser is always going to be the student everywhere you look. First of all, we are obviously the ones who pay for our careers, aren't we? We are giving our time and dedication to this, and one does not give up because one wants to but because of the situation of the country and not because of what is happening at the moment, but because there is a high unemployment rate. When I started my career I had a relatively good job, but in my case, I became unemployed... well, I've been getting around it and I've been getting other jobs, but I haven't had job stability".

Access to both hardware and internet connectivity technologies also encourages dropout, with participants indicating that:

P8: "I live in a municipality that is very distant. I live in Bajo Nariño and here the technology is not very good. In this case I am talking about the internet, I have a lot of problems with it", "I usually have difficulties accessing the university platforms, so when I have the opportunity to enter I try to do everything I can" and "... during the pandemic I tried to connect to the classes, but as I told you the connectivity ... was not very good and so I gave up. I know you have the resources, but it's not your fault that my connectivity is so bad…".

P9: "Doing work is difficult for me, because I don't have internet at home, so for me this factor limits my training process" and "I have internet, as I said, for payment, I buy it for days and if I don't have money to recharge, I don't have it and there is no way to do work".

P10: "Maybe it's interconnectivity, right? ... Having access to the internet and a computer is difficult because you know that there is none in those parts. So, I have to do my work on my mobile phone".

P11: "That where I live the internet does not work so well ... for example when it rains and thunders, the internet is down".

With regard to the academic determinant variables, the study participants considered that they did not have sufficient skills in the area of mathematics and research, as follows:

P4: "first of all, I have problems in mathematics".

P5: "The most complicated thing is researching, especially researching to be able to do the work left in the classroom".

P5: "Well, mostly when I studied mathematics, but not the rest. Because mathematics is a little bit more complex, so you have to pay more attention".

In accordance with the above P15 expressed:

P15: "At the moment I think they could develop additional material, because it is a very impractical subject and the exercises are very few, everything is theoretical …".

On other pedagogical shortcomings that can lead to dropout P2 reported:

P2: "… What I don't like to do is to analyse documents, so the difficulty of these documents means that they don't understand the content of the subjects".

Finally, in relation to the institutional determinant P1 considered that the lack of knowledge of the assessment rubrics affects academic performance:

P1: "At least the case studies you send them in, the rubric says that they are from 1 to 5 points, and I always get 1 point and that's when I ask myself, "What did I do wrong that I only get one point out of five points? Ahh what a pity, I graded you wrong and you have to correct the grade so if you don't complain you keep that point and that's it...you don't even know what I did wrong or what I did right".

For P14, who said he financed his tuition with the university, he said:

P14: "The lack of money and the excessive debt collection calls are disturbing me. I have decided not to continue and to get rid of this problem".

In the case of teachers, the lack of support and contact in the teaching process increases the possibility of dropping out. In this respect:

P1: "As I said, the most complicated thing is the lack of support from the teachers when they don't answer your questions in a timely manner. There are teachers, most of them, that you ask them a question and first the semester is over before they solve it".

P3: "… it would be better if he could call you and the teacher would be available to call you on a WhatsApp number and he will clarify any doubts".

P4: "As far as that is concerned, let's say that the student as such will always just say that he/she will not perform as well as he/she would in a face-to-face mode".

P5: "The main difficulty is that the teacher is not always available".

P10: "As I say, there should be more interaction".

P16: "Let's say that sometimes teachers send you material, but we have to find the means to understand and research on our own, but if they ... were more in touch with us it would be easier to study".

Communication with HEIs is another critical variable related to attrition, as participants studying online indicated:

P1: "Requests are often ignored by the university".

P4: "Tutors should communicate more with us".

P10: "A bit more assertive communication, they should call students more. Sometimes I've seen comments on the net that say: it's not that I'm trying to get through and the call doesn't go through, it's that I've asked for such and such and they don't give me an answer".

Phase Two

With the variables identified in phase one and based on the narratives expressed by dropouts and rural students with the intention of not completing their academic programme, a model was defined consisting of five causal loops. Thus, the first loop called R1 (see Figure 17) indicated that students with greater social disparities, limited to economic disparities, drop out more, which ends up exacerbating the social disparities resulting in a higher number of dropouts. In turn, the number of rural dropouts is influenced by the dropout rate, which is a result of GPA intervention, communication with teachers and time spent studying. In relation to the academic average, the lower the motivation for study, the lower the self-management of learning and the greater the academic difficulties of rural students, the higher the dropout rate. Similarly, less communication between teachers and students and less dedication of students to their studies, due to lack of time, can lead to higher dropout rates.
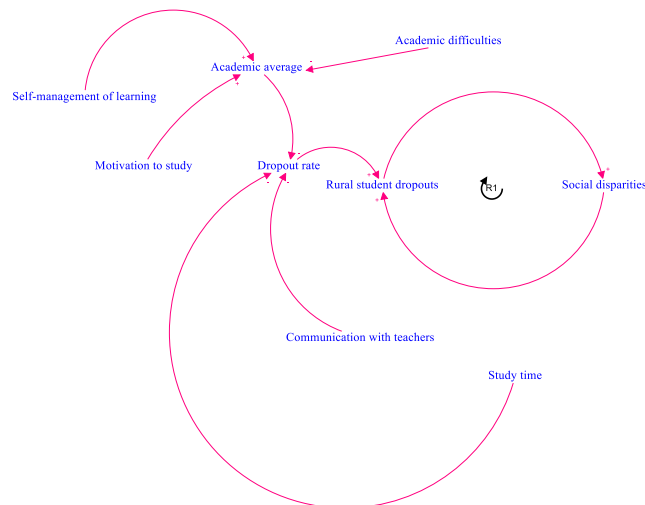
Figure 17. Reinforcement loop R1.

The second loop (R2) related that the greater the social disparities, the greater the work obligations, and the higher the age of entry into higher education, which is a result of the same

disparities. This decreases the time spent on studies, increasing the drop-out rate and, consequently, a higher number of rural dropouts. Figure 18shows the loop.
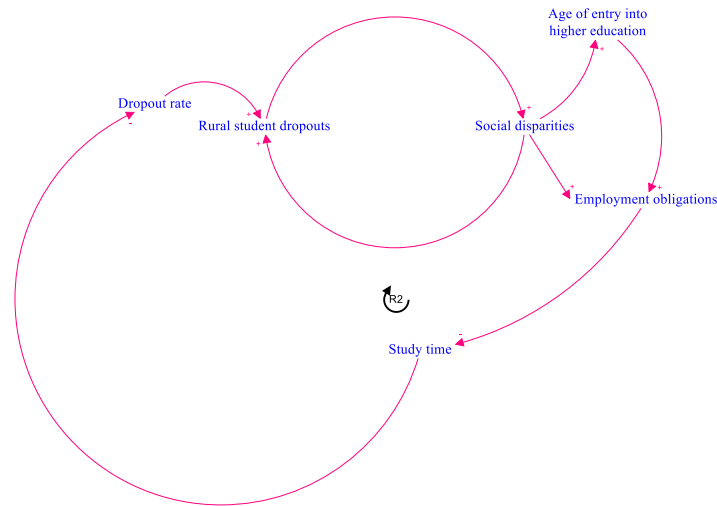

Figure 18. Reinforcement loop R2.

Similarly, for the third loop (R3) the more social disparities rural students have, the more family obligations they tend to have to some extent because of the later age of entry to higher education. This decreases the time spent on their educational process, raising dropout rates in this student population, and, as a result, having more dropouts and greater social disparities. Figure 19 depicts this loop.

For the fourth loop (R4, Figure 20), the greater the social disparities, the later the age of entry to higher education and the greater the difficulties in accessing technologies, which generates greater academic problems, especially in the basic sciences, resulting in a lower average, and this in turn in a higher dropout rate, leading to more students dropping out and increasing social disparities.
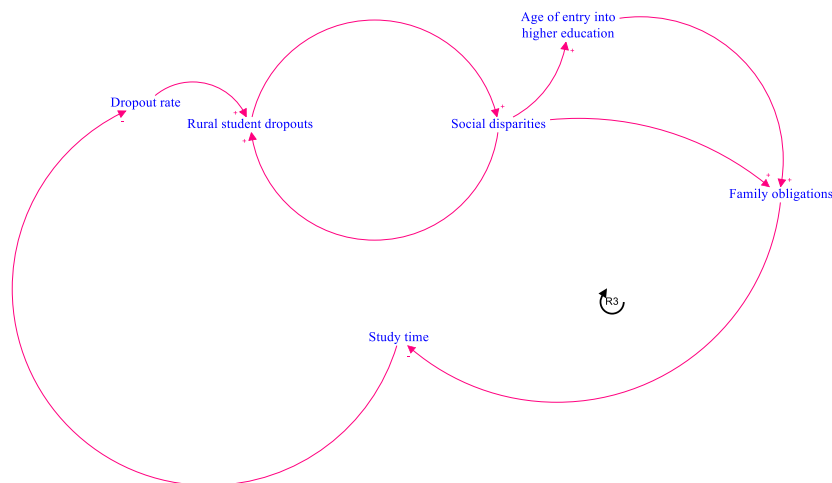
Figure 19. Reinforcement loop R3.
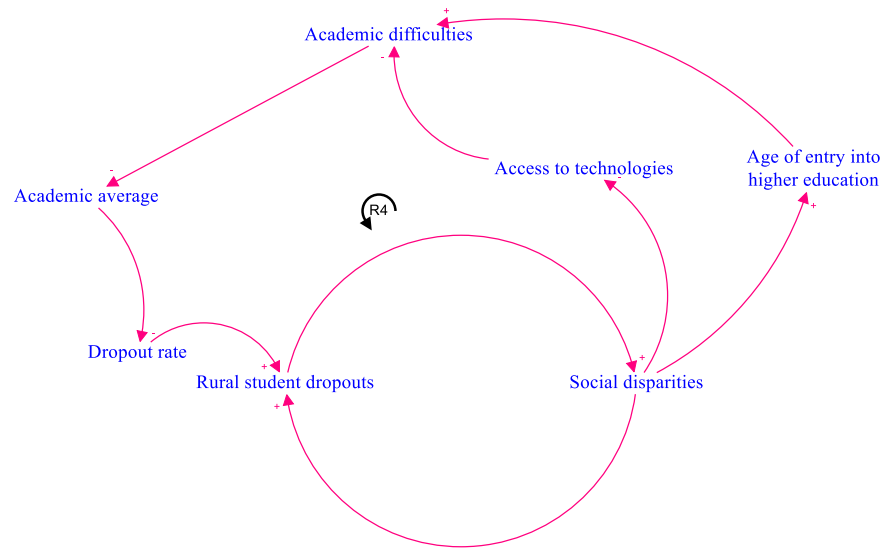
Figure 20. Reinforcement loop R4.

Finally, for the fifth loop (B1), the greater the social disparities, the less access rural students have to technology, the greater the academic difficulties and the lower the academic average, which in turn increases the dropout rate and the number of rural students who drop out, thus increasing social disparities. Figure 21 presents the B1 loop and Figure 22 the Full form causal loop diagram, linking the five loops described. This diagram reveals the relationships between the variables identified in the narratives and provides an input for the elaboration of dynamic hypotheses.
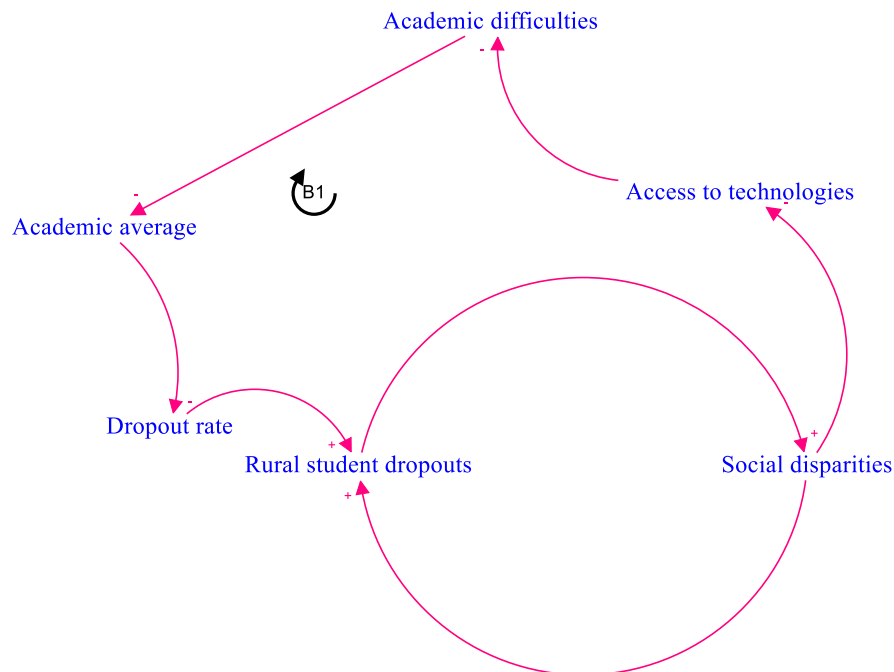
Figure 21. Balance loop B1.
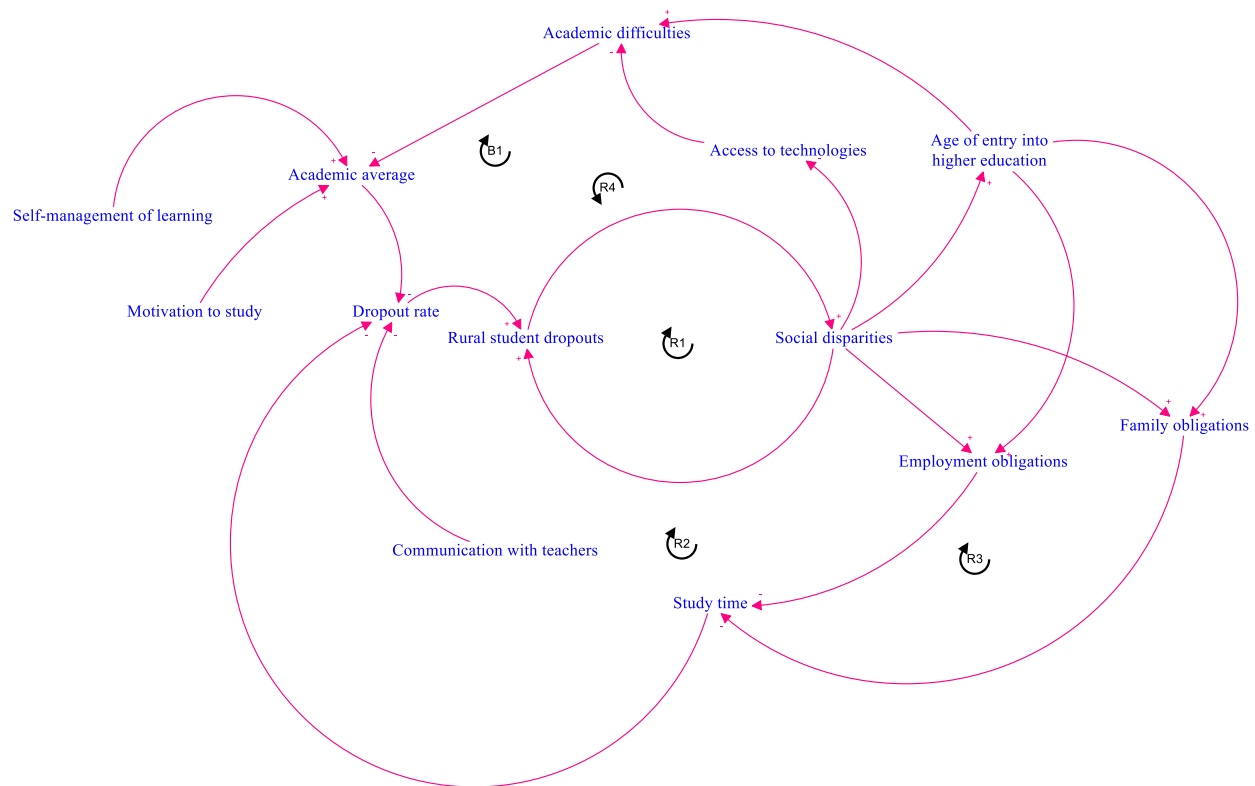
Figure 22. Model based on a causal loop diagram.

Conclusions and final remarks

This study sought to establish the causes of student dropout in rural higher education using a model based on systems thinking. Thus, it was based on the lived experience of dropouts and students with the intention of dropping out in HEIs located in Colombia. Having said this, regarding the first research question, it was possible to establish the explanatory variables involved in dropout in rural higher education. In this case, it was detected that difficulties in self-management of learning, lack of motivation, as well as family and work obligations, have an impact on the materialisation of this phenomenon. This finding is in line with previous research carried out on this student population, such as that of Guzmán et al. (2021b), Guzmán et al. (2021c), Nishat et al. (2020), Bania and Kvernmo (2016) and De Hart and Venter (2013), among others.

With regard to the social and economic determinant variables, financial difficulties were the most recurrent cause expressed by the students, so that the payment of tuition fees, expenses associated with the educational level, as well as those related to their personal life can materialise the phenomenon of dropout, being in agreement with the work of Muñoz (2013), as well as De Hart and Vent (2013). Another variable identified was the difficulties of access to technologies (internet and hardware), which impedes the correct educational process.

In the case of the academic determinant variables, the non-acquisition of basic skills such as mathematics and research at previous levels affects the academic average, leading the student to drop out, this finding being like that reported by Bania and Kvernmo, (2016), as well as Castleman and Meyer (2020). Finally, in relation to the explanatory variables of the institutional determinant,

ignorance of evaluative aspects may lead students to end their academic process early. Similarly, the pressure of collection management when financing tuition fees with HEIs can be a catalyst for dropout. On the other hand, assertive communication with HEIs has the capacity to mitigate dropout in the rural student population. This aspect had been considered critical in the research of Guzmán and Cánovas (2020), as well as Nishat et al. (2020). Although the above variables are able to explain the dropout of rural students, the participants in this study considered that the role of teachers is central to their permanence, given that the lack of contact and participation of teachers in the educational process can lead them to drop out. It is noteworthy that the Causal Loop Diagram showed that the variables that directly affect the dropout rate are: communication with teachers, study time and academic average.

Under the variables identified, the proposed model allows for an understanding of the complexity of this phenomenon in the rural population, given that the social disparities they experience affect the four determinants, which is why the role of the state cannot be limited solely to financing enrolments or to assigning the treatment of this phenomenon to the HEIs, but rather requires a coordinated effort with the development of public and institutional policies aimed at the following aspects:

1. Improve the development of basic science and research competencies at previous academic levels.

2. Ensure that the academic process for rural students takes place at similar times to their urban counterparts.

3. Generate programmes that alleviate students' financial obligations beyond tuition fees.

4. Generate support centres to facilitate the family obligations of students, especially for women with minor children.

5. Improve internet connectivity in rural areas in order to facilitate the teaching and learning process. In addition, develop programmes aimed at facilitating access to technologies that include hardware and software.

6. Monitor the effectiveness of P&GO programmes for this student population, in relation to the development of self-management learning skills and motivation to study.

7. Mediate better interaction between teacher and rural learner.

Furthermore, the study of dropout in rural populations should be further explored for effective prevention and mitigation, in order to convey the personal and social benefits of education and to eliminate the social disparities experienced in these areas. This can be done by means of a simulation model based on the dynamic hypotheses outlined here, thus allowing for the long-term exploration of public policy alternatives.

General Conclusions

The objective of the present thesis was achieved, which was to establish which strategies within the framework of Colombian public policies should be implemented by the State and HEIs for the analysis, diagnosis, prevention, and mitigation of dropout among students located in or coming from rural areas enrolled in undergraduate programmes, by means of the development of models. Its implementation has provided new insights into the drop-out among the rural student population.

In the light of the above, rural populations in Colombia have historically lived in conditions of social disparities, hence the State has developed public policies to guarantee access to higher education, and to be able to materialise the benefits of the educational level in these areas (Hung et al., 2020; Semke & Sheridan, 2012; Byun et al., 2012; Arnold et al., 2005). In this scenario, the importance of access to this level of education for the rural population came under public scrutiny in the 1990s, through changes to the political constitution, the General Education Law and the ten-year education plans. However, during the ten-year plans of 1996 and 2006, no clear strategies were defined to facilitate access to higher education for rural students. It was only after the signing of the peace agreement that a clear policy was established for the level of education in rural areas.

Having said this, the strategies put forward in the framework of current public policies continue to concentrate their efforts on the achievement of coverage, through the availability of educational services, the adaptation of education to the rural environment, acceptability in terms of quality, and accessibility to financing. This has resulted in the design of various educational models for this type of population, driven by the development of public policies, which in the case of the country has moved from face-to-face education to flexible educational models based on virtuality. Such models have the potential to increase the number of rural students accessing higher education in Colombia, based on the effects of their implementation in other settings, as shown by Baldwin and James (2010); Perna and Steele (2011); Byun et al. (2012) and Yiu and Yun (2017).

Recognising this first step forward, the state must pay attention to other key aspects of higher education, such as student dropout due to the consequences it has for society at large, hence the importance of preventing and mitigating it.

Under the current policies of access to higher education based on financing or self-financing of students and their families, dropout as an educational phenomenon has the capacity to aggravate the socio-economic conditions of students, especially when the sunk cost of students and their families is higher than what is assumed by the State or by the HEIs themselves. Therefore, in order to begin the social transformation of rural areas through education, this event must be prevented and mitigated. It is important to recognise that during COVID-19 the economic effects for the students and their families were greater in relation to dropout, due to the fact that the state and HEIs did not have the capacity to guarantee the right to access the educational service, as well as related services such as access to information and communication technologies, electricity, among others.

In this scenario, reflections arise on the importance of preventing and mitigating dropout in rural higher education, since this phenomenon has the capacity to increase social disparities, especially when 50% of this rural population in colombia lived in monetary poverty and 27.9% in extreme poverty, with a monthly income of less than 199,828 pesos (USD 53.17). However, public policies should not be limited to passing on the cost to HEIs or to the state, but regardless of who should bear the cost, this phenomenon should be addressed, as it limits other social benefits beyond the economic one.

In the framework of such prevention and mitigation, the State and HEIs should focus their efforts on the development and complementation of existing public and institutional policies, which allow for the treatment of multiple variables of dropout over time. The present thesis highlights the interest of the academic community to deepen on the individual and socio-economic reasons that lead students to drop out, being the counterfactual case the academic and institutional ones. Thus, the family obligations of rural populations should be reduced, creating support structures that seek to care for minors and direct relatives of the elderly, to free up hours that could be devoted to study. Similarly, plans and programmes should be managed to reduce the student's work obligations to improve the socio-economic conditions of the student and his/her family, for example: support programmes in higher education or universal income. Within the framework of the new plans or programmes, the implementation of subsidies for student transport to HEIs or rental subsidies should be analysed.

However, with regard to information and communication technologies, rural students have difficulties in accessing them given the economic conditions in these areas. This means that students who are enrolled in undergraduate programmes in the virtual mode are unable to develop their training process correctly, especially those who are enrolled in the virtual mode.

Similarly, one of the main challenges for the Colombian education system is the decrease in the age of entry of students to higher education, which is the result of high repetition rates in primary or secondary school levels, or the late age of entry to basic education. On the other hand, the evidence throughout the chapters of this thesis reveals the relationship between the age of entry and family obligations, since some rural students begin their higher education training process once their children enter basic or secondary education. In relation to the educational level of the parents and the work they do, as central elements within the support structures, it was established that the lower the educational level of the parents, the higher the risk of dropping out.

Now, the thesis makes it clear that, in order to guarantee the permanence of students at the higher education level, the development of competencies in primary and secondary basic education must be strengthened, which is why equal quality conditions must be guaranteed between rural and urban students, given that there is a gap that is evident in the results of the standardised tests developed by the ICFES. In the same way, it is necessary to continue strengthening the PyGO programmes of the HEIs in order to achieve a greater coverage of these programmes among the rural student population.

In relation to new findings, which differ from previous studies, it was identified that for rural students in the virtual mode, there are indications that academic variables do not have an impact on dropout (e.g., knowledge of the curriculum, transition time between secondary and higher education, completion of virtual courses, etc.). This differs from the findings of Choi and Kim (2018), Stewart et al. (2015) and Orellana et al. (2020). Regarding the condition of vulnerability such as armed conflict or forced displacement, the majority of dropouts reported not having such a condition. However, it is a variable that has been little explored in the literature, so it should be studied in greater depth in both rural and urban populations, given that when it is associated with other variables it can be a catalyst for dropout in higher education, as Yasmin (2013) argues.

In a more generalised way, not limited only to virtual learners and related to the new findings, the educational level of the father was associated with dropout at the educational level which is a discrepancy with previous studies such as Guzman et al. (2020b), Barbosa-Camargo et al. (2021) and Lundetræ (2011), as dropout is usually related to the educational level of the mother.

This may be as a result of the low penetration of rural women in the education system (Radiowala & S. Molwane, 2021). On the other hand, linking students to institutional welfare schemes and extracurricular activities neither limits dropout, going against the results presented by Warner (1993) and Nishat et al. (2020).

Based on the findings of this thesis, the treatment of these variables by the State and HEIs could significantly reduce dropout in rural higher education, and thus materialise the personal and social benefits of this level of education.

The main advances in the field of knowledge from this thesis include the following:

1. A first analysis of public policies for access to higher education in rural areas in Colombia.
2. The development of a simulation model aimed at evaluating the economic effects of dropout for students and their families, HEIs and the State, based on the current policies of access to rural higher education in Colombia, which can be adapted and adopted in countries with similar characteristics in the policies of access to higher education.
3. The generation of a holistic vision of the variables involved in dropout in rural higher education, based on a review of the evidence available in the literature, and the confrontation of these variables in the Colombian rural context.
4. The identification of variables that explain desertion in rural higher education in the virtual modality and in a generalised manner in the educational subsystem.
5. The development of a model based on systems thinking, based on the experience of the students, which made it possible to establish the interaction of the explanatory variables of this phenomenon to establish the causes and effects of these interactions.

In general terms, throughout the thesis there was constant feedback to decision-makers on public and institutional policies for the prevention and mitigation of dropout in rural higher education in Colombia.

With regard to future lines of research that should be addressed for the prevention and mitigation of dropout in rural populations, empirical studies should be carried out that allow for a comprehensive evaluation of the policies of access to the educational level, so the community in general is invited to carry out studies related to the efficiency of flexible modalities for rural populations, the consequences on learning of the lack of access to technology, the influence of credit as a means of financing higher education in populations in vulnerable conditions, among others.

Similarly, mathematical modelling and computational simulation should continue to explore the effects of the decisions taken in matters of public policy for the treatment of dropout, due to the fact that they are generally lacking at the educational level. This is due to the difficulty of having time-dependent data due to the lack of robust systems that, firstly, take into account rurality and, secondly, disaggregate the information by department, municipality or location of the students.

Regarding the explanatory variables, the new findings found in this thesis should be further explored to confirm whether they are present in scenarios other than rural Colombia. The academic community is also encouraged to study the effect of the armed conflict and the legal status of students on dropout in rural higher education, the effectiveness of financial support, learning

preferences, the level of resilience of students, the commitment to the academic objective, the level of commitment to pedagogical teaching strategies and classroom learning, among others.

References

Abbasi, S., Ayoob, T., Malik, A., & Memon, S. I. (2020). Perceptions of students regarding E-learning during Covid-19 at a private medical college. *Pakistan Journal of Medical Sciences*, *36*(COVID19-S4). https://doi.org/10.12669/pjms.36.COVID19-S4.2766

Adrogue, C., & García de Fanelli, A. M. (2018). Gaps in persistence under open-access and tuition-free public higher education policies. *Education Policy Analysis Archives*, *26*, 126. https://doi.org/10.14507/epaa.26.3497

Agronet. (2021). *Trabajadores rurales no han escapado de la crisis por la COVID-19*. https://www.agronet.gov.co/Noticias/Paginas/Trabajadores-rurales-no-han-escapado-de-la-crisis-por-la-COVID-19.aspx

Alkan, N. (2014). Humor, Loneliness and Acceptance: Predictors of University Drop-out Intentions. *Procedia - Social and Behavioral Sciences*, *152*, 1079–1086. https://doi.org/10.1016/j.sbspro.2014.09.278

Allmendinger, J., Kleinert, C., Pollak, R., Vicari, B., Wölfel, O., Althaber, A., Antoni, M., Christoph, B., Drasch, K., Janik, F., Künster, R., Laible, M.-C., Leuze, K., Matthes, B., Ruland, M., Schulz, B., & Trahms, A. (2019). Adult Education and Lifelong Learning. In H.-P. Blossfeld & H.-G. Roßbach (Eds.), *Education as a Lifelong Process* (Vol. 3, pp. 325–346). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-23162-0_17

Alyoussef, I. (2021). E-Learning System Use During Emergency: An Empirical Study During the COVID-19 Pandemic. *Frontiers in Education*, *6*, 677753. https://doi.org/10.3389/feduc.2021.677753

Amare, M. Y., & Simonova, S. (2021). Global challenges of students dropout: A prediction model development using machine learning algorithms on higher education datasets. *SHS Web of Conferences*, *129*, 09001. https://doi.org/10.1051/shsconf/202112909001

Amaya de Ochoa, G. (2002). Cobertura e inequidad. Educación Superior en Colombia. *Educación y Educadores*, 9–20. https://educacionyeducadores.unisabana.edu.co/index.php/eye/article/view/508

Améstica-Rivas, L., King-Domínguez, A., Sanhueza Gutiérrez, D. A., & Ramírez González, V. (2020). Efectos económicos de la deserción en la gestión universitaria: el caso de una universidad pública chilena. *Hallazgos*, *18*(35). https://doi.org/10.15332/2422409X.5772

Aparicio-Chueca, P., Domínguez-Amorós, M., & Maestro-Yarza, I. (2021). Beyond university dropout. An approach to university transfer. *Studies in Higher Education*, *46*(3), 473–484. https://doi.org/10.1080/03075079.2019.1640671

Aragon, S. R., & Johnson, E. S. (2008). Factors Influencing Completion and Noncompletion of Community College Online Courses. *American Journal of Distance Education*, *22*(3), 146–158. https://doi.org/10.1080/08923640802239962

Arias, J. (2017). Problemas y retos de la educación rural colombiana. *Revista Educación y Ciudad*, *33*, 53–62. https://doi.org/10.36737/01230425.v0.n33.2017.1647

Arias-Velandia, N., Rincón-Báez, W. U., & Cruz-Pulido, J. M. (2018). Desempeño de mujeres y hombres en educación superior presencial, virtual y a distancia en Colombia. *Panorama*, *12*(22), 57–69. https://doi.org/10.15765/pnrm.v12i22.1142

Armstrong, S. N., Early, J. O., Burcin, M. M., Bolin, K., Holland, N., & No, S. (2018). New Media Tools Impact on Online, Health Science Students' Academic Persistence and Support: Lessons Learned from Two Pilot Studies. *TechTrends*, *62*(3), 266–275. https://doi.org/10.1007/s11528-018-0261-1

Arnold, M. L., Newman, J. H., Gaddy, B. B., & Dean, C. B. (2005). look at the condition of rural education research: setting a direction for future research. *Journal of Research in Rural Education*, *20*(6), 1-25.

Arvone, R. (1978). Políticas educativas durante el frente nacional 1958-1974. *Revista Colombiana de Educación*, *1*, 8. https://doi.org/10.17227/01203916.4933

Atchoarena, D., Holmes, K., Atchoarena, D., & Holmes, K. (2005). The Role of Agricultural Colleges and Universities in Rural Development and Lifelong Learning in Asia. *Asian Journal of Agriculture and Development*, *2*(1–2), 15–24. https://doi.org/10.22004/AG.ECON.165777

Avendaño, W. R., Paz, L., & Rueda, V. G. (2017). Políticas públicas y educación superior: análisis conceptual del contexto colombiano. *Revista Venezolana de Gerencia*, *22*(79), 467–485. https://www.redalyc.org/jatsRepo/290/29055964008/html/index.html

Bala, B. K., Arshad, F. M., & Noh, K. M. (2017). *System Dynamics*. Springer Singapore. https://doi.org/10.1007/978-981-10-2045-2

Baldwin, G. & James, R. (2010). Access and Equity in Higher Education. In *International Encyclopedia of Education* (pp. 334-340). Elsevier.

Bania, E. V., & Kvernmo, S. E. (2016). Tertiary education and its association with mental health indicators and educational factors among Arctic young adults: the NAAHS cohort study. *International Journal of Circumpolar Health*, *75*(1), 32086. https://doi.org/10.3402/ijch.v75.32086

Barbosa-Camargo, M. I., García-Sánchez, A., & Ridao-Carlini, M. L. (2021). Inequality and Dropout in Higher Education in Colombia. A Multilevel Analysis of Regional Differences, Institutions, and Field of Study. *Mathematics*, *9*(24), 3280. https://doi.org/10.3390/math9243280

Barragán, S. P., & González, L. (2017). Acercamiento a la deserción estudiantil desde la integración social y académica. *Revista de la Educación Superior*, *46*(183), 63–86. https://doi.org/10.1016/j.resu.2017.05.004

Barragán, S., & Cala, F. (2018). La productividad de los profesores en las Instituciones de Educación Superior colombiana. En G. Eljach, J. A. Escobar, L. Muñoz, G. F. Niño, & J. A. Escobar (Eds). *Aportes académicos para la agenda legislativa en educación* (pp. 131-154). Centro de Investigaciones y Altos Estudios legislativos - CAEL. http://cael.senado.gov.co/cael/publicaciones/57-serie-5/file

Barragán, S., & Gonzalez, O. (2022). Explanatory Variables of Dropout in Colombian Public Education: Evolution Limited to Coronavirus Disease. *European Journal of Educational Research*, *11*(1), 287–304. https://doi.org/10.12973/eu-jer.11.1.287

Barragán, S., & Rodríguez, R. B. (2015). Diagnóstico y seguimiento de la deserción en la Universidad de Bogotá Jorge Tadeo Lozano. In S. Barragán & R. B. Rodríguez (Eds.), *La Universidad de Bogotá Jorge Tadeo Lozano en el camino de la retención estudiantil. Más Cerca de la reducción del abandono estudiantil en la Tadeo* (1st ed., pp. 62–63). Universidad de Bogotá Jorge Tadeo Lozano.

Barreto, L., Cerón, L. & Fernández, A. (2010). Metodologías para la investigación en políticas públicas. In *Enfoques para el análisis de políticas públicas* (1st ed., pp. 347-363). UNAL.

Basilaia, G., & Kvavadze, D. (2020). Transition to Online Education in Schools during a SARS-CoV-2 Coronavirus (COVID-19) Pandemic in Georgia. *Pedagogical Research*, *5*(4). https://doi.org/10.29333/pr/7937

Bazlur, A. Q. M., & Sarker, M. S. A. (2008). Strategic Intervention of ODL in Diploma in Youth Development Works in Bangladesh. *Turkish Online Journal of Distance Education*, *9*(4), 89–96. https://eric.ed.gov/?id=EJ816482

Bean, J. P. (1986). Assessing and reducing attrition. *New Directions for Higher Education*, *1986*(53), 47–61. https://doi.org/10.1002/he.36919865306

Becerra, M., Alonso, J. D., Frias, M., Angel-Urdinola, D., & Vergara, S. (2020). *Latin America and the Caribbean: Tertiary Education*. The World Bank. https://documents1.worldbank.org/curated/en/720271590700883381/COVID-19-Impact-on-Tertiary-Education-in-Latin-America-and-the-Caribbean.pdf

Beck, H. P., & Milligan, M. (2014). Factors influencing the institutional commitment of online students. *The Internet and Higher Education*, *20*, 51–56. https://doi.org/10.1016/j.iheduc.2013.09.002

Becker, G. S. (1962). Investment in Human Capital: A Theoretical Analysis. *Journal of Political Economy*, *70*(5), 9–49. https://www.jstor.org/stable/1829103

Behr, A., Giese, M., Teguim Kamdjou, H. D., & Theune, K. (2020). Dropping out of university: a literature review. *Review of Education*, *8*(2), 614–652. https://doi.org/10.1002/rev3.3202

Bernal, O. O. B. (2018). Evaluación financiera ocasionada por la deserción estudiantil en la Universidad Libre Seccional Cúcuta. *Interfaces*, *1*(1), 67–81. https://revistas.unilibre.edu.co/index.php/interfaces/article/view/3676

Bernardo, A. B., Galve-González, C., Núñez, J. C., & Almeida, L. S. (2022). A Path Model of University Dropout Predictors: The Role of Satisfaction, the Use of Self-Regulation Learning Strategies and Students' Engagement. *Sustainability*, *14*(3), 1057. https://doi.org/10.3390/su14031057

Bettinger, E. (2015). Need-Based Aid and College Persistence: The Effects of the Ohio College Opportunity Grant. *Educational Evaluation and Policy Analysis*, *37*(1), 102S-119S. https://doi.org/10.3102/0162373715576072

Bilige, S., & Gan, Y. (2020). Hidden School Dropout Among Adolescents in Rural China: Individual, Parental, Peer, and School Correlates. *The Asia-Pacific Education Researcher*, *29*(3), 213–225. https://doi.org/10.1007/s40299-019-00471-3

Broadbent, J., & Poon, W. L. (2015). Self-regulated learning strategies & academic achievement in online higher education learning environments: A systematic review. *The Internet and Higher Education*, *27*, 1–13. https://doi.org/10.1016/j.iheduc.2015.04.007

Brown, R. (2004). *Quality Assurance in Higher Education: The UK Experience Since 1992* (1st ed.). Routledge Falmer. https://www.routledge.com/Quality-Assurance-in-Higher-Education-The-UK-Experience-Since-1992/Brown-Brown/p/book/9780415511346

Bungău, C., Pop, A. P., & Borza, A. (2017). Dropout of first year undergraduate students: A case study of engineering students. *Balkan Region Conference on Engineering and Business Education*, *2*(1), 349–356. https://doi.org/10.1515/cplbu-2017-0046

Byun, S., Irvin, M. J., & Meece, J. L. (2012). Predictors of Bachelor's Degree Completion among Rural Students at Four-Year Institutions. *The Review of Higher Education*, *35*(3), 463–484. https://doi.org/10.1353/rhe.2012.0023

Byun, S., Meece, J. L., & Irvin, M. J. (2012). Rural-Nonrural Disparities in Postsecondary Educational Attainment Revisited. *American Educational Research Journal*, *49*(3), 412–437. https://doi.org/10.3102/0002831211416344

Callender, C., & Dougherty, K. J. (2018). Student Choice in Higher Education—Reducing or Reproducing Social Inequalities? *Social Sciences*, *7*(10), 189. https://doi.org/10.3390/socsci7100189

Cameron-Standerford, A., Menard, K., Edge, C., Bergh, B., Shayter, A., Smith, K., & VandenAvond, L. (2020). The Phenomenon of Moving to Online/Distance Delivery as a Result of COVID-19: Exploring Initial Perceptions of Higher Education Faculty at a Rural Midwestern University. *Frontiers in Education*, *5*, 583881. https://doi.org/10.3389/feduc.2020.583881

Castellar, C. E., & Uribe, J. I. (2004). Capital humano y señalización: evidencia para el área metropolitana de Cali, 1988-2000. *Revista Sociedad y Economía*, *6*, 51–79. https://sociedadyeconomia.univalle.edu.co/index.php/sociedad_y_economia/%20article%20/view%20/3864

Castleman, B. L., & Meyer, K. E. (2020). Can Text Message Nudges Improve Academic Outcomes in College? Evidence from a West Virginia Initiative. *The Review of Higher Education*, *43*(4), 1125–1165. https://doi.org/10.1353/rhe.2020.0015

Castro-Lopez, A., Cervero, A., Galve-González, C., Puente, J., & Bernardo, A. B. (2021). Evaluating critical success factors in the permanence in Higher Education using multi-criteria decision-making. *Higher Education Research & Development*, 1–19. https://doi.org/10.1080/07294360.2021.1877631

CEPAL. (2016). *La protección social de la población rural en Colombia: una propuesta desde la perspectiva de la familia y sus necesidades*. United Nations.

CEPAL. (2021). *UNESCO COVID-19 education response: how many students are at risk of not returning to school? Advocacy paper*. UNESCO

Cerezo, R., Bernardo, A., Esteban, M., & Tuero, M. S. y E. (2015). Programas para la promoción de la autorregulación en educación superior: un estudio de la satisfacción diferencial entre metodología presencial y virtual. *European Journal of Education and Psychology*, *8*(1), 30–36. https://doi.org/10.1016/j.ejeps.2015.10.004

Chalfin, A., & Deza, M. (2019). The intergenerational effects of education on delinquency. *Journal of Economic Behavior & Organization*, *159*, 553–571. https://doi.org/10.1016/j.jebo.2017.07.034

Chankseliani, M., Gorgodze, S., Janashia, S., & Kurakbayev, K. (2020). Rural disadvantage in the context of centralised university admissions: a multiple case study of Georgia and Kazakhstan. *Compare: A Journal of Comparative and International Education*, *50*(7), 995–1013. https://doi.org/10.1080/03057925.2020.1761294

Chatterji, P., & Li, Y. (2021). Effects of COVID-19 on school enrollment. *Economics of Education Review*, *83*, 102128. https://doi.org/10.1016/j.econedurev.2021.102128

Chen, R., & DesJardins, S. L. (2008). Exploring the Effects of Financial Aid on the Gap in Student Dropout Risks by Income Level. *Research in Higher Education*, *49*(1), 1–18. https://doi.org/10.1007/s11162-007-9060-9

Chetty, R., Friedman, J. N., Hendren, N., Stepner, M., & Team, T. O. I. (2020). *The Economic Impacts of COVID-19: Evidence from a New Public Database Built Using Private Sector Data* (Working Paper No. 27431). National Bureau of Economic Research. https://doi.org/10.3386/w27431

Choi, H. J., & Kim, B. U. (2018). Factors Affecting Adult Student Dropout Rates in the Korean Cyber-University Degree Programs. *The Journal of Continuing Higher Education*, *66*(1), 1–12. https://doi.org/10.1080/07377363.2017.1400357

Choi, H. J., & Park, J.-H. (2018). Testing a path-analytic model of adult dropout in online degree programs. *Computers & Education*, *116*, 130–138. https://doi.org/10.1016/j.compedu.2017.09.005

Choudhary, L. A., & Hammayun, A. (2015). Economic Effects of Student Dropouts: A Comparative Study. *Journal of Global Economics*, *03*(02), 1–4. https://doi.org/10.4172/2375-4389.1000137

Chung, J. Y., & Lee, S. (2019). Dropout early warning systems for high school students using machine learning. *Children and Youth Services Review*, *96*, 346–353. https://doi.org/10.1016/j.childyouth.2018.11.030

Cochran, J. D., Campbell, S. M., Baker, H. M., & Leeds, E. M. (2014). The Role of Student Characteristics in Predicting Retention in Online Courses. *Research in Higher Education*, *55*(1), 27–48. https://doi.org/10.1007/s11162-013-9305-8

Colombia Aprende. (2021). *Generación E.* https://especiales.colombiaaprende.edu.co/generacione/

Colombian Institute for the Evaluation of Education. (2019). *Más colombiano que nunca*. https://portal.icetex.gov.co/mascolombianoquenunca/

Comrey, A. L., & Lee, H. B. (2013). *A First Course in Factor Analysis* (0 ed.). Psychology Press. https://doi.org/10.4324/9781315827506

Congress of the Republic of Colombia. (1991). *Political Constitution of the Republic of Colombia*. http://www.secretariasenado.gov.co/senado/basedoc/constitucion_politica_1991.html.

Congress of the Republic of Colombia. (1994). *Law 115 of 1994*. https://www.mineducacion.gov.co/1621/articles-85906_archivo_pdf.pdf

Contreras, C. (2018). Rendimiento académico de los alumnos de último año de Licenciaturas presenciales e Ingeniería de la Facultad Multidisciplinaria de Ilobasco durante el ciclo I - 2017. *Anuario de Investigación*, *7*, 125–139. http://localhost:80/xmlui/handle/123456789/217

Cook, J., Burke, P. J., Bunn, M., & Cuervo, H. (2021). Should I stay or should I go? The impact of the COVID-19 pandemic on regional, rural and remote undergraduate students at an Australian University. *Educational Review*, 1–15. https://doi.org/10.1080/00131911.2021.1958756

Cristia, J., & Pulido, J. (2020). Education in Latin America and the Caribbean: segregated and unequal. In M. Busso & Messina (Eds.), *The inequality crisis: Latin America and the Caribbean at the crossroad* (1st ed., pp. 166–193).

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297–334. https://doi.org/10.1007/BF02310555

Cruz, M., Álvarez, J., Ávalos, I., Cuevas, M., de Barros, C., Díaz, F., González Castllón, E., González, D., Hernández, A., Ibáñez, P., & Lizarte, E. J. (2020). Evaluation of the Emotional and Cognitive Regulation of Young People in a Lockdown Situation Due to the Covid-19 Pandemic. *Frontiers in Psychology*, *11*, 565503. https://doi.org/10.3389/fpsyg.2020.565503

Currie, J., & Moretti, E. (2003). Mother's Education and the Intergenerational Transmission of Human Capital: Evidence from College Openings. *The Quarterly Journal of Economics*, *118*(4), 1495–1532. https://doi.org/10.1162/003355303322552856

Cvetković-Vega, A., Maguiña, J. L., Soto, A., Lama-Valdivia, J., & Correa López, L. E. (2021). Cross-sectional studies. *Revista de La Facultad de Medicina Humana*, *21*(1), 164–170. https://doi.org/10.25176/RFMH.v21i1.3069

DANE. (2021). *Pobreza monetaria 2021 enfoque diferencial*. Departamento Administrativo Nacional de Estadística

Davies, G. K. (2001). *Higher education is a public-health issue*. *48*(14), pB16. https://www.chronicle.com/article/higher-education-is-a-public-health-issue/

De Clercq, M., Galand, B., & Frenay, M. (2017). Transition from high school to university: a person-centered approach to academic achievement. *European Journal of Psychology of Education*, *32*(1), 39–59. https://doi.org/10.1007/s10212-016-0298-5

De Hart, K., & Venter, J. M. P. (2013). Comparison of urban and rural dropout rates of distance students. *Perspectives in Education*, *31*(1), 66–76. https://www.ajol.info/index.php/pie/article/view/87989

Delnoij, L., Janssen, J., Dirkx, K., Gijselaers, H., de Groot, R. H., Neroni, J., de Bie, M., & Martens, R. (2021). Predicting Completion: The Road to Informed Study Decisions in Higher Online Education. *Frontiers in Education*, *6*, 668922. https://doi.org/10.3389/feduc.2021.668922

Denning, J. T. (2017). College on the Cheap: Consequences of Community College Tuition Reductions. *American Economic Journal: Economic Policy*, *9*(2), 155–188. https://doi.org/10.1257/pol.20150374

Dennis, M. J. (2020). The impact of COVID-19 on the world economy and higher education. *Enrollment Management Report*, *24*(9), 3–3. https://doi.org/10.1002/emt.30720

Departamento Nacional de Planeación. (2014). *Definición de categorías de ruralidad*. Departamento Nacional de Planeación.

Dill, D. D., & Soo, M. (2005). Academic quality, league tables, and public policy: A cross-national analysis of university ranking systems. *Higher Education*, *49*(4), 495–533. https://doi.org/10.1007/s10734-004-1746-8

Donoso, S., & Schiefelbein, E. (2007). Análisis De Los Modelos Explicativos De Retención De Estudiantes En La Universidad: Una Visión Desde La Desigualdad Social. *Estudios Pedagógicos*, *XXXIII*(1), 7–27. https://www.redalyc.org/articulo.oa?id=173514133001

Duque, J. F. (2021). Who embodies the evaluative state? Programmatic actors in the chilean and colombian policies of quality assurance in higher education. *European Policy Analysis*, *7*(S1), 48–63. https://doi.org/10.1002/epa2.1109

Dužević, I., Mikulić, J., & Baković, T. (2018). An extended framework for analysing higher education performance. *Total Quality Management & Business Excellence*, *29*(5–6), 599–617. https://doi.org/10.1080/14783363.2016.1224083

Eaton, J. S. (2010). Accreditation and the Federal Future of Higher Education. *Academe*, *96*(5), 21–24.

Eaton, J. S. (2012). The Future of Accreditation. *Planning for Higher Education*, *40*(3), 8–15.

Erdogan, B., Bauer, T. N., Truxillo, D. M., & Mansfield, L. R. (2012). Whistle While You Work: A Review of the Life Satisfaction Literature. *Journal of Management*, *38*(4), 1038–1083. https://doi.org/10.1177/0149206311429379

Erola, J., Jalonen, S., & Lehti, H. (2016). Parental education, class and income over early life course and children's achievement. *Research in Social Stratification and Mobility*, *44*, 33–43. https://doi.org/10.1016/j.rssm.2016.01.003

Esteban, M., Bernardo, A., Tuero, E., Cervero, A., & Casanova, J. (2017). Variables influyentes en progreso académico y permanencia en la universidad. *European Journal of Education and Psychology*, *10*(2), 75–81. https://doi.org/10.1016/j.ejeps.2017.07.003

Ethington, C. A. (1990). A psychological model of student persistence. *Research in Higher Education*, *31*(3), 279–293. https://doi.org/10.1007/BF00992313

Everitt, B. S., Landau, S., Leese, M., & Stahl, D. (2011). An Introduction to Classification and Clustering. In *Wiley Series in Probability and Statistics* (pp. 1–13). John Wiley & Sons, Ltd. https://doi.org/10.1002/9780470977811.ch1

Expósito, C. D., & Marsollier, R. G. (2020). Virtualidad y educación en tiempos de COVID-19. Un estudio empírico en Argentina. *Educación y Humanismo*, *22*(39). https://doi.org/10.17081/eduhum.22.39.4214

Fack, G., & Grenet, J. (2015). Improving College Access and Success for Low-Income Students: Evidence from a Large Need-Based Grant Program. *American Economic Journal: Applied Economics*, *7*(2), 1–34. https://doi.org/10.1257/app.20130423

Faizullina, K., Kausova, G., Kalmataeva, Z., Nurbakyt, A., & Buzdaeva, S. (2013). Career Intentions and Dropout Causes Among Medical Students in Kazakhstan. *Medicina*, *49*(6), 45. https://doi.org/10.3390/medicina49060045

Favale, T., Soro, F., Trevisan, M., Drago, I., & Mellia, M. (2020). Campus traffic and e-Learning during COVID-19 pandemic. *Computer Networks*, *176*, 107290. https://doi.org/10.1016/j.comnet.2020.107290

Fermoso, P. (1989). El modelo fenomenológico de investigación en pedagogía social. *Revista Educar, 14* (15), 121-136. https://doi.org/10.5565/rev/educar.541

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research* (1st ed.). Addison-Wesley.

Flick, U. (2012). *Introducción a la investigación cualitativa*. Ediciones Morata.

Fonseca, G., & García, F. (2016). Permanencia y abandono de estudios en estudiantes universitarios: un análisis desde la teoría organizacional. Revista de la Educación Superior, 45(179), 25–39. https://doi.org/10.1016/j.resu.2016.06.004

Forrester, W. (2013). *Industrial Dynamics*. M.I.T. Press.

Georg, W. (2009). Individual and institutional factors in the tendency to drop out of higher education: a multilevel analysis using data from the Konstanz Student Survey. *Studies in Higher Education*, *34*(6), 647–661. https://doi.org/10.1080/03075070802592730

Ghignoni, E. (2017). Family background and university dropouts during the crisis: the case of Italy. *Higher Education*, *73*(1), 127–151. https://doi.org/10.1007/s10734-016-0004-1

Gibbs, R. M. (1998). College completion and return migration among rural youth. In P. L. Swaim & T. R. Teixeira (Eds.), *Rural education and training in the new economy: The myth of the rural skills gap* (1st ed., pp. 61–80). Iowa State University Press.

Gildehaus, L., Cotter, P., Buck, S., Sousa, M., Hueffer, K., & Reynolds, A. (2019). The Research, Advising, and Mentoring Professional: a Unique Approach to Supporting Underrepresented Students in Biomedical Research. *Innovative Higher Education*, *44*(2), 119–131. https://doi.org/10.1007/s10755-018-9452-0

Giovagnoli, P. I. (2002). *Determinantes de la deserción y graduación universitaria: una aplicación utilizando modelos de duración*. http://sedici.unlp.edu.ar/handle/10915/3436

Godfrey, D., Seleznyov, S., Anders, J., Wollaston, N., & Barrera-Pedemonte, F. (2019). A developmental evaluation approach to lesson study: exploring the impact of lesson study in London schools. *Professional Development in Education*, *45*(2), 325–340. https://doi.org/10.1080/19415257.2018.1474488

Gruzina, Y., Firsova, I., & Strielkowski, W. (2021). Dynamics of Human Capital Development in Economic Development Cycles. *Economies*, *9*(2), 67. https://doi.org/10.3390/economies9020067

Guillen, F. E. (2019). Investigación cualitativa: Método fenomenológico hermenéutico. *Propósitos y Representaciones*, *7*(1), 201–229. https://doi.org/10.20511/pyr2019.v7n1.267

Guzmán, A., & Rodriguez-Canovas, B. (2020). Identificación de estudiantes rurales con intención de desertar en programas de pregrado en modalidad virtual: Análisis de clústeres caso Colombia. In *Innovación Docente e Investigación en Educación: avanzando en el proceso de enseñanza-aprendizaje* (1st ed., pp. 519–532). Dykinson.

Guzmán, A., Barragán, S., & Cala-Vitery, F. (2021a). Dropout in Rural Higher Education: A Systematic Review. *Frontiers in Education*, *6*, 727833. https://doi.org/10.3389/feduc.2021.727833

Guzmán, A., Barragán, S., & Cala-Vitery, F. (2021b). Rurality and Dropout in Virtual Higher Education Programmes in Colombia. *Sustainability*, *13*(9), 4953. https://doi.org/10.3390/su13094953

Guzmán, A., Barragán, S., & Cala-Vitery, F. (2021c). Rural Population and COVID-19: A Model for Assessing the Economic Effects of Drop-Out in Higher Education. *Frontiers in Education*, *6*, 812114. https://doi.org/10.3389/feduc.2021.812114

Guzmán, A., Barragán, S., and Cala-Vitery, F. (2021d). *Forrester Diagram Level of Technical Education*. https://doi.org/10.6084/m9.figshare.16944244.v1

Guzmán, A., Barragán, S., and Cala-Vitery, F. (2021e). *Forrester Diagram Level of Professional Education*. https://doi.org/10.6084/m9.figshare.16944235.v1

Guzmán, A., Quecano, L. I., Segovia- García, N., & Rodríguez-Cánovas, B. (2020). Abandono estudiantil en Educación Superior y su relación con la comunicación en programas de modalidad virtual: Colombia. In *La comunicación especializada del siglo XXI, 2020, ISBN 978-84-486-2434-7, págs. 939-957* (pp. 939–957). McGraw-Hill Interamericana de España.

Guzmán, A., Valencia, L. I., Moreno W, & Segovia, N. (2020). Factores pre-matricula asociados a la deserción en educación superior en modalidad virtual: una revisión sistematizada. In *Inclusión, Tecnología y Sociedad: investigación e innovación en educación* (pp. 784–794). Dykinson.

Hällsten, M. (2017). Is Education a Risky Investment? The Scarring Effect of University Dropout in Sweden. *European Sociological Review*, jcw053. https://doi.org/10.1093/esr/jcw053

Hanushek, E. A., & Woessmann, L. (2020). The economic impacts of learning losses. *OECD Education Working Papers*, *225*, 1–24. https://doi.org/10.1787/19939019

Heidrich, L., Victória Barbosa, J. L., Cambruzzi, W., Rigo, S. J., Martins, M. G., & dos Santos, R. B. S. (2018). Diagnosis of learner dropout based on learning styles for online distance learning. *Telematics and Informatics*, *35*(6), 1593–1606. https://doi.org/10.1016/j.tele.2018.04.007

Herbaut, E., & Geven, K. (2020). What works to reduce inequalities in higher education? A systematic review of the (quasi-)experimental literature on outreach and financial aid. *Research in Social Stratification and Mobility*, *65*, 100442. https://doi.org/10.1016/j.rssm.2019.100442

Heublein, U., Hutzsch, C., Schreiber, J., Sommer, D., & Besuch, G. (2010). *Ursachen des Studienabbruchs in Bachelor-und herkömmlichen Studiengängen: Ergebnisse einer bundesweiten Befragung von Exmatrikulierten des Studienjahres 2007/2008 [Causes for dropout in bachelor and traditional study programmes. Results of a national survey of exmatriculated students of the academic year 2007/2008]* (1st ed.).

Heublein, U., Spangenberg, K., & Sommer, D. (2002). *Ursachen des Studienabbruchs. Analyse 2002.* (1st ed.). HIS GmbH.

Himmel, E. (2002). Modelo de análisis de la deserción estudiantil en la educación superior. *Calidad En La Educación*, *17*, 91. https://doi.org/10.31619/caledu.n17.409

Hines, E. M., Borders, L. D., & Gonzalez, L. M. (2015). "It takes fire to make steel": Stories of two African American males finding purpose through their college experiences. *Journal for Multicultural Education*, *9*(4), 225–247. https://doi.org/10.1108/JME-01-2015-0001

Hung, M., Smith, W. A., Voss, M. W., Franklin, J. D., Gu, Y., & Bounsanga, J. (2020). Exploring Student Achievement Gaps in School Districts Across the United States. *Education and Urban Society*, *52*(2), 175–193. https://doi.org/10.1177/0013124519833442

Husserl, E. (1998). *Invitación a la fenomenología*. Paidós.

Ibarrola, M. (2020). Los Centros de Bachillerato Tecnológico Agropecuario y la producción agrícola escolar en la formación para el trabajo. *Revista mexicana de investigación educativa*, *25*(84), 91–119. http://www.scielo.org.mx/scielo.php?script=sci_abstract&pid=S1405-66662020000100091&lng=es&nrm=iso&tlng=es

Jaramillo, J. (1989). La Educación durante los gobiernos liberales, 1930 – 1946. In *Nueva Historia de Colombia* (pp. 83-97). Editorial Planeta.

Jeno, L. M., Danielsen, A. G., & Raaheim, A. (2018). A prospective investigation of students' academic achievement and dropout in higher education: a Self-Determination Theory approach. *Educational Psychology*, *38*(9), 1163–1184. https://doi.org/10.1080/01443410.2018.1502412

Kara, M., Erdoğdu, F., Kokoç, M., & Cagiltay, K. (2019). Challenges Faced by Adult Learners in Online Distance Education: A Literature Review. *Open Praxis*, *11*(1), 5. https://doi.org/10.5944/openpraxis.11.1.929

Kehm, B. M., Larsen, M. R., & Sommersel, H. B. (2019). Student dropout from universities in Europe: A review of empirical literature. *Hungarian Educational Research Journal*, *9*(2), 147–164. https://doi.org/10.1556/063.9.2019.1.18

Kemper, L., Vorhoff, G., & Wigger, B. U. (2020). Predicting student dropout: A machine learning approach. *European Journal of Higher Education*, *10*(1), 28–47. https://doi.org/10.1080/21568235.2020.1718520

Kerres, M. (2020). Against All Odds: Education in Germany Coping with Covid-19. *Postdigital Science and Education*, *2*(3), 690–694. https://doi.org/10.1007/s42438-020-00130-7

Kilian, P., Loose, F., & Kelava, A. (2020). Predicting Math Student Success in the Initial Phase of College With Sparse Information Using Approaches From Statistical Learning. *Frontiers in Education*, *5*, 502698. https://doi.org/10.3389/feduc.2020.502698

Kim, D., & Kim, S. (2018). Sustainable Education: Analyzing the Determinants of University Student Dropout by Nonlinear Panel Data Models. *Sustainability*, *10*(4), 954. https://doi.org/10.3390/su10040954

Klein, D. (2019). Das Zusammenspiel zwischen akademischer und sozialer Integration bei der Erklärung von Studienabbruchintentionen. Eine empirische Anwendung von Tintos Integrationsmodell im deutschen Kontext. *Zeitschrift für Erziehungswissenschaft*, *22*(2), 301–323. https://doi.org/10.1007/s11618-018-0852-9

Laaser, W. (2018). El impacto económico y las posturas de los actores principales en un ámbito universitario digitalizado. *Revista de Educación a Distancia (RED)*, *57*. https://revistas.um.es/red/article/view/327361

Lance, L. (2011). Nonproduction Benefits of Education. In *Handbook of the Economics of Education* (Vol. 4, pp. 183–282). Elsevier. https://doi.org/10.1016/B978-0-444-53444-6.00002-X

Larroucau, T. (2016). Estudio de los factores determinantes de la deserción en el sistema universitario chileno. *Revista Estudios de Políticas Públicas*, *1*(1), 1–23. https://doi.org/10.5354/0719-6296.2015.38351

Lázaro, N., Callejas, Z., & Griol, D. (2020). Factores que inciden en la deserción estudiantil en carreras de perfil Ingeniería Informática. *Revista Fuentes*, *1*(22), 105–126. https://doi.org/10.12795/revistafuentes.2020.v22.i1.09

Lee, Y., & Choi, J. (2011). A review of online course dropout research: implications for practice and future research. *Educational Technology Research and Development*, *59*(5), 593–618. https://doi.org/10.1007/s11423-010-9177-y

Lehan, T. J., Hussey, H. D., & Shriner, M. (2018). The influence of academic coaching on persistence in online graduate students. *Mentoring & Tutoring: Partnership in Learning*, *26*(3), 289–304. https://doi.org/10.1080/13611267.2018.1511949

Lerma, C. A. (2007). *El derecho a la educación en Colombia*. Fundación Laboratorio de Políticas Públicas.

Lewine, R., Manley, K., Bailey, G., Warnecke, A., Davis, D., & Sommers, A. (2019). College Success Among Students From Disadvantaged Backgrounds: "Poor" and "Rural" Do Not Spell Failure. *Journal of College Student Retention: Research, Theory & Practice*, 152102511986843. https://doi.org/10.1177/1521025119868438

Lewine, R., Manley, K., Bailey, G., Warnecke, A., Davis, D., & Sommers, A. (2019). College Success Among Students From Disadvantaged Backgrounds: "Poor" and "Rural" Do Not Spell Failure. *Journal of College Student Retention: Research, Theory & Practice*, 152102511986843. https://doi.org/10.1177/1521025119868438

Li, I. W., & Carroll, D. R. (2020). Factors influencing dropout and academic performance: an Australian higher education equity perspective. *Journal of Higher Education Policy and Management*, *42*(1), 14–30. https://doi.org/10.1080/1360080X.2019.1649993

Lipset, S. M. (1959). Some Social Requisites of Democracy: Economic Development and Political Legitimacy. *American Political Science Review*, *53*(1), 69–105. https://doi.org/10.2307/1951731

Lischer, S., Caviezel Schmitz, S., Krüger, P., Safi, N., & Dickson, C. (2021). Distance Education in Social Work During the COVID-19 Pandemic: Changes and Challenges. *Frontiers in Education*, *6*, 720565. https://doi.org/10.3389/feduc.2021.720565

Liu, S. (2021). Can ranking contribute to the quality assurance of higher education? An examination of the Chinese Disciplinary Ranking. *Cambridge Journal of Education*, *51*(2), 263–281. https://doi.org/10.1080/0305764X.2020.1829548

López-Aguilar, D., & Álvarez-Pérez, P. R. (2021). Modelo predictivo PLS-SEM sobre intención de abandono académico universitario durante la COVID-19. *Revista Complutense de Educación*, *32*(3), 451–461. https://doi.org/10.5209/rced.70507

Lundetræ, K. (2011). Does Parental Educational Level Predict Drop-out from Upper Secondary School for 16- to 24-year-olds When Basic Skills are Accounted For? A Cross Country Comparison. *Scandinavian Journal of Educational Research*, *55*(6), 625–637. https://doi.org/10.1080/00313831.2011.555925

Mailizar, M., Almanthari, A., Maulina, S., & Bruce, S. (2020). Secondary School Mathematics Teachers' Views on E-learning Implementation Barriers during the COVID-19 Pandemic: The Case of Indonesia. *Eurasia Journal of Mathematics, Science and Technology Education*, *16*(7), em1860. https://doi.org/10.29333/ejmste/8240

Marginson, S. (2011). Equity, status and freedom: a note on higher education. *Cambridge Journal of Education*, *41*(1), 23–36. https://doi.org/10.1080/0305764X.2010.549456

Marginson, S. (2016). The worldwide trend to high participation higher education: dynamics of social stratification in inclusive systems. *Higher Education*, *72*(4), 413–434. https://doi.org/10.1007/s10734-016-0016-x

Marginson, S. (2019). Limitations of human capital theory. *Studies in Higher Education*, *44*(2), 287–301. https://doi.org/10.1080/03075079.2017.1359823

Márquez-Vera, C., Morales, C. R., & Soto, S. V. (2013). Predicting School Failure and Dropout by Using Data Mining Techniques. *IEEE Revista Iberoamericana de Tecnologías Del Aprendizaje*, *8*(1), 7–14. https://doi.org/10.1109/RITA.2013.2244695

Mayer, A., Patel, R., & Gutierrez, M. (2015). Four-Year Effects on Degree Receipt and Employment Outcomes from a Performance-Based Scholarship Program in Ohio. *SSRN Electronic Journal*, 1–34. https://doi.org/10.2139/ssrn.2594482

McCowan, T. (2016). Three dimensions of equity of access to higher education. *Compare: A Journal of Comparative and International Education*, *46*(4), 645–665. https://doi.org/10.1080/03057925.2015.1043237

McMahon, W. W. (2010). The External Benefits of Education. In *International Encyclopedia of Education* (pp. 260–271). Elsevier. https://doi.org/10.1016/B978-0-08-044894-7.01226-4

Meisalo, V., Sutinen, E., & Torvinen, S. (2002). How to improve a virtual programming course? *32nd Annual Frontiers in Education*, *1*, T2G-11-T2G-16. https://doi.org/10.1109/FIE.2002.1157951

Meisalo, V., Sutinen, E., & Torvinen, S. (2003). Choosing appropriate methods for evaluating and improving the learning process in distance programming courses. *33rd ASEE/IEEE Frontiers in Education Conference*, 11–16.

Mejía, L. F., Reina, M., Oviedo, S. & Rivera, A. (2020). Planes Nacionales de Desarrollo en Colombia: Análisis structural y recomendaciones de política. Fedesarrollo.

Melo-Becerra, L. A., Ramos-Forero, J. E., & Hernández-Santamaría, P. O. (2017). La educación superior en Colombia: situación actual y análisis de eficiencia1. *Desarrollo y Sociedad*, *78*, 59–111. https://www.redalyc.org/jatsRepo/1691/169149895003/html/index.html

Mendoza, G. E., Palacio, J. I. & Pinilla, N. E. (2013). *Ruling T-666/13*.

Mgqwashu, E. M., Timmis, S., de Wet, T., & Madondo, N. E. (2020). Transitions from rural contexts to and through higher education in South Africa: negotiating misrecognition. *Compare: A Journal of Comparative and International Education*, *50*(7), 943–960. https://doi.org/10.1080/03057925.2020.1763165

Migali, G., & Zucchelli, E. (2017). Personality traits, forgone health care and high school dropout: Evidence from US adolescents. *Journal of Economic Psychology*, *62*, 98–119. https://doi.org/10.1016/j.joep.2017.06.007

Ministery of National Education. (2013). *Acuerdo Nacional para Disminuir la Deserción en la Educación Superior*. Ministry of National Education.

Ministry of National Education of Colombia. (2006). *Plan decenal de educación 1996-2005*. Ministry of National Education.

Ministry of National Education of Colombia. (2017), *Plan especial de educación rural: hacia el desarrollo rural y la construcción de paz*. Ministry of National Education.

Ministry of National Education of Colombia. (2018). *Plan Rural de Educación Superior: estrategias de fortalecimiento de capacidades para el desarrollo territorial*. Ministry of National Education.

Ministry of National Education of Colombia. (2020). *Generación E*. https://edusitios.colombiaaprende.edu.co/generacione/#.

Ministry of National Education. (2015). *Guía para la implementación del modelo de gestión de permanencia y graduación estudiantil en instituciones de educación superior* (1st ed.). Ministry of National Education.

Mncube, V., Mutongoza, B. H., & Olawale. (2021). Managing higher education institutions in the context of Covid-19 stringency: Experiences of stakeholders at a rural South African university. *Perspectives in Education*, *39*(1). https://doi.org/10.18820/2519593X/pie.v39.i1.24

Monroy Hernández, C. L. (2012). De Federalismo a Regeneración. El paso de Estados Soberanos a Departamentos Político-Administrativos. Boyacá, 1886-1903. *HiSTOReLo. Revista de Historia Regional y Local*, *4*(7), 218–239. http://www.scielo.org.co/scielo.php?script=sci_abstract&pid=S2145-132X2012000100009&lng=pt&nrm=iso&tlng=es

Montenegro, C. E., & Patrinos, H. A. (2014). *Comparable estimates of returns to schooling around the world*. Banco Mundial. http://documents1.worldbank.org/curated/en/830831468147839247/pdf/WPS7020.pdf

Moreno, W., Segovia, N., Grillo, C., Dworaczek, H. O., & Coy, H. V. (2019). Naturaleza del endeudamiento como base de la propuesta de política pública para la educación superior en Colombia desde 2013. In *Innovación Docente e Investigación en Ciencias Sociales, Económicas y Jurídicas* (pp. 25–36). Dykinson.

Morris, L. V., Wu, S.-S., & Finnegan, C. L. (2005). Predicting Retention in Online General Education Courses. *American Journal of Distance Education*, *19*(1), 23–36. https://doi.org/10.1207/s15389286ajde1901_3

Mughal, A. W. (2020). Secondary school students who drop out of school in rural Pakistan: The perspectives of fathers. *Educational Research*, *62*(2), 199–215. https://doi.org/10.1080/00131881.2020.1755604

Muñoz, S. M. (2013). "I Just Can't Stand Being Like This Anymore": Dilemmas, Stressors, and Motivators for Undocumented Mexican Women in Higher Education. *Journal of Student Affairs Research and Practice*, *50*(3), 233–249. https://doi.org/10.1515/jsarp-2013-0018

Nachar, N. (2008). The Mann-Whitney U: A Test for Assessing Whether Two Independent Samples Come from the Same Distribution. *Tutorials in Quantitative Methods for Psychology*, *4*(1), 13–20. https://doi.org/10.20982/tqmp.04.1.p013

National Council of Higher Education. (2014). *Acuerdo por lo Superior 2034: Propuesta de Política Pública Para la Excelencia de la Educación Superior en Colombia en el Escenario de la Paz*. Ministry of National Education.

National Planning Department. (1991). *Plan Nacional de Desarrollo. La revolución pacífica*. DNP.

National Planning Department. (1995). *Plan Nacional de Desarrollo. El salto social*. DNP

National Planning Department. (1999). *Plan Nacional de Desarrollo. Cambio para construir la paz*. DNP.

National Planning Department. (2003). *Plan Nacional de Desarrollo. Hacia un Estado Comunitario*. DNP.

National Planning Department. (2007). *Una aproximación a la vulnerabilidad*. DNP.

National Planning Department. (2011). *Plan Nacional de Desarrollo. Prosperidad para Todos*. DNP.

National Planning Department. (2019). *Plan Nacional de Desarrollo. Pacto por Colombia, Pacto por la Equidad*. DNP.

Ness, E. C., & Tucker, R. (2008). Eligibility Effects on College Access: Under-Represented Student Perceptions of Tennessee's Merit Aid Program. *Research in Higher Education*, *49*(7), 569–588. https://doi.org/10.1007/s11162-008-9096-5

Nightingale, A. (2009). A guide to systematic literature reviews. *Surgery (Oxford)*, *27*(9), 381–384. https://doi.org/10.1016/j.mpsur.2009.07.005

Nishat, N., Islam, Y. M., Biplob, K. B. Md. B., Mustain, U., & Hossain, M. K. (2020). Empowering tertiary level students to solve their own study-related problems to improve study performance. *Journal of Applied Research in Higher Education*, *12*(5), 1117–1133. https://doi.org/10.1108/JARHE-07-2018-0136

Nizar, N. I., & Nazir, A. (2020). Faktor Human Capital Pada Pertumbuhan Ekonomi Kreatif. *Jurnal Mandiri : Ilmu Pengetahuan, Seni, Dan Teknologi*, *4*(1), 52–65. https://doi.org/10.33753/mandiri.v4i1.103

Oasi, O., Maggio, S., Pacella, S., & Molgora, S. (2019). Dropout and narcissism: an exploratory research about situational factors and personality variables of the psychotherapist. *Research in Psychotherapy (Milano)*, *22*(2), 369. https://doi.org/10.4081/ripppo.2019.369

OECD. (2017). *Estudios Económicos de la OCDE - Colombia*. OECD.

OECD. (2018a). *Reviews of School Resources: Colombia 2018*. OECD.

OECD. (2018b). *Tertiary Graduation Rate*. https://doi.org/10.1787/8a8385cf-en

Oliveira, E. H. T., Carvalho, J. R. H., Oliveira, H. A. B. F., Gadelha, B. F., Lucena, K. T., Ramos, D. B., Ramos, I. M. M., Nascimento, P. B., & Carvalho, I. A. V. A. (2018). Higher Education in the Amazon: Challenges and Initiatives. In A. I. Cristea, I. I. Bittencourt, & F. Lima (Eds.), *Higher Education for All. From Challenges to Novel Technology-Enhanced Solutions* (Vol. 832, pp. 17–31). Springer International Publishing. https://doi.org/10.1007/978-3-319-97934-2_2

Orellana, D., Segovia, N., & Cánovas, B. R. (2020). El abandono estudiantil en programas de educación superior virtual: revisión de literatura. *Revista de la Educación Superior*, *49*(194), 45–62. http://resu.anuies.mx/ojs/index.php/resu/article/view/1124

Ortiz, E., & Dehon, C. (2013). Roads to Success in the Belgian French Community's Higher Education System: Predictors of Dropout and Degree Completion at the Université Libre de Bruxelles. *Research in Higher Education*, *54*(6), 693–723. https://doi.org/10.1007/s11162-013-9290-y

Özdoğan, E. (2021). Dynamic effects of higher education expenditures on human capital and economic growth: an evaluation of OECD countries. *Policy Reviews in Higher Education*, *5*(2), 174–196. https://doi.org/10.1080/23322969.2021.1893125

Packham, G., Jones, P., Miller, C., & Thomas, B. (2004). E-learning and retention: key factors influencing student withdrawal. *Education + Training*, *46*(6/7), 335–342. https://doi.org/10.1108/00400910410555240

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Systematic Reviews*, *10*(1), 89. https://doi.org/10.1186/s13643-021-01626-4

Palacio Sprockel, L. E., Vargas Babilonia, J. D., & Monroy Toro, S. L. (2020). Análisis bibliométrico de estudios sobre factores socioeconómicos en estudiantes universitarios. *Educación y Educadores*, *23*(3), 355–375. https://doi.org/10.5294/edu.2020.23.3.1

Palacio, L. E., Vargas, J. D., & Monroy, S. L. (2020). Análisis bibliométrico de estudios sobre factores socioeconómicos en estudiantes universitarios. *Educación y Educadores*, *23*(3), 355–375. https://doi.org/10.5294/edu.2020.23.3.1

Park, J.-H., & Choi, H. J. (2009). Factors Influencing Adult Learners' Decision to Drop Out or Persist in Online Learning. *Educational Technology & Society*, *12*(4), 207–217.

Patton, M. Q. (2015). *Qualitative research & evaluation methods: integrating theory and practice* (Fourth edition). SAGE Publications, Inc.

Pérez, C. N., Cerón, E. A., Suárez, R. P., Mera, M. E., Briones, N. P., Zambrano, L. Y., & Barreto Rosado, M. E. (2019). Deserción y repitencia en estudiantes de la carrera de Enfermería matriculados en el período 2010-2015. Universidad Técnica de Manabí. Ecuador. 2017. *Educación Médica*, *20*(2), 84–90. https://doi.org/10.1016/j.edumed.2017.12.013

Perna, L. W., & Steele, P. (2011). The Role of Context in Understanding the Contributions of Financial Aid to College Opportunity. *Teachers College Record: The Voice of Scholarship in Education*, *113*(5), 895–933. https://doi.org/10.1177/016146811111300507

Perry, S. (2010). *La pobreza rural en Colombia*. RIMISP Centro Latinoamericano para el Desarrollo Rural.

Pillay, A. L., & Ngcobo, H. S. B. (2010). Sources of Stress and Support among Rural-Based First-Year University Students: An Exploratory Study. *South African Journal of Psychology*, *40*(3), 234–240. https://doi.org/10.1177/008124631004000302

Pino, J. W. (2017). Aspectos metodológicos para evaluar una política pública. *RHS-Revista Humanismo y Sociedad*, *5*, 1–7. https://doi.org/10.22209/rhs.v5n1a01

Pokhrel, S., & Chhetri, R. (2021). A Literature Review on Impact of COVID-19 Pandemic on Teaching and Learning. *Higher Education for the Future*, *8*(1), 133–141. https://doi.org/10.1177/2347631120983481

Potra, S., Pugna, A., Pop, M.-D., Negrea, R., & Dungan, L. (2021). Facing COVID-19 Challenges: 1st-Year Students' Experience with the Romanian Hybrid Higher Educational System. *International Journal of Environmental Research and Public Health*, *18*(6), 3058. https://doi.org/10.3390/ijerph18063058

Presidency of the Republic of Colombia. (2016). *Final agreement for the end of the conflict and the construction of a stable and lasting peace.* Presidency of the Republic of Colombia.

Proyecto ALFA GUIA DCI-ALA/2010/94. (2013). *Estudio sobre Políticas Nacionales sobre el abandono en la Educación Superior en los países que participan en el Proyecto ALFA-GUIA* (1st ed.). Gestión Universitaria Integral del Abandono.

Qayyum, A., Zipf, S., Gungor, R., & Dillon, J. M. (2019). Financial aid and student persistence in online education in the United States. *Distance Education*, *40*(1), 20–31. https://doi.org/10.1080/01587919.2018.1553561

Qu, Y. (2009). Research and application of diversified model in yardstick of higher education tuition. *2009 International Conference on Test and Measurement*, *2*, 319–322. https://doi.org/10.1109/ICTM.2009.5413043

Radiowala, A. A., & S. Molwane, M. (2021). A Study on the Challenges Faced by Rural Women in Accessing Education. *Journal of Scientific Research*, *65*(04), 13–17. https://doi.org/10.37398/JSR.2021.650402

Radovan, M. (2019). Should I Stay, or Should I Go? Revisiting Student Retention Models in Distance Education. *Turkish Online Journal of Distance Education*, 29–40. https://doi.org/10.17718/tojde.598211

Ramírez, S. M. R., Velásquez, D. U., Zapata, E. P., Velásquez, C., & Ramírez, E. M. H. (2020). Perfiles de riesgo de deserción en estudiantes de las sedes de una universidad colombiana. *Revista de Psicología*, *38*(1), 275–297. https://doi.org/10.18800/psico.202001.011

Rapley, P., Davidson, L., Nathan, P., & Dhaliwal, S. S. (2008). Enrolled nurse to registered nurse: Is there a link between initial educational preparation and course completion? *Nurse Education Today*, *28*(1), 115–119. https://doi.org/10.1016/j.nedt.2007.03.006

Rashid, A. Q. M. B., & Sarker, M. S. A. (2008). Strategic Intervention of ODL in Diploma in Youth Development Works in Bangladesh. *Turkish Online Journal of Distance Education*, *9*(4), 89–96. https://eric.ed.gov/?id=EJ816482

Respondek, L., Seufert, T., Stupnisky, R., & Nett, U. E. (2017). Perceived Academic Control and Academic Emotions Predict Undergraduate University Student Success: Examining Effects on Dropout Intention and Achievement. *Frontiers in Psychology*, *8*. https://doi.org/10.3389/fpsyg.2017.00243

Rice, J., Rojjanasrirat, W., & Trachsel, P. (2013). Attrition of On-line Graduate Nursing Students Before and After Program Structural Changes. *Journal of Professional Nursing*, *29*(3), 181–186. https://doi.org/10.1016/j.profnurs.2012.05.007

Richardson, G. P., & Pugh, A. L. (1981). *Introduction to System Dynamics Modeling with DYNAMO*. MIT Press.

Richburg-Hayes, L., Patel, R., Brock, T., de la Campa, E., Rubb, T., & Valenzuela, I. (2015). *Providing More Cash for College: Interim Findings from the Performance-Based Scholarship Demonstration in California*. MDRC. https://eric.ed.gov/?id=ED560254

Rodríguez Urrego, M. (2019). La investigación sobre deserción universitaria en Colombia 2006-2016. Tendencias y resultados. *Pedagogía y Saberes*, *51*. https://doi.org/10.17227/pys.num51-8664

Rodríguez, C. A., Alfonso, T. & Cavelier, I. (2009). *El desplazamiento afro*. Universidad de los Andes.

Rodríguez, M. (2019). La investigación sobre deserción universitaria en Colombia 2006-2016. Tendencias y resultados. *Pedagogía y Saberes*, *51*. https://doi.org/10.17227/pys.num51-8664

Rodríguez-Hernández, C. F., Cascallar, E., & Kyndt, E. (2020). Socio-economic status and academic performance in higher education: A systematic review. *Educational Research Review*, *29*, 100305. https://doi.org/10.1016/j.edurev.2019.100305

Rubin, R. B. (2011). The Pell and the Poor: A Regression-Discontinuity Analysis of On-Time College Enrollment. *Research in Higher Education*, *52*(7), 675–692. https://doi.org/10.1007/s11162-011-9215-6

Rueda, S. M. R., Velásquez, D. U., Zapata, E. P., Velásquez, C., & Ramírez, E. M. H. (2020). Perfiles de riesgo de deserción en estudiantes de las sedes de una universidad colombiana. Revista de Psicología, 38(1), 275–297. https://doi.org/10.18800/psico.202001.011

Sahoo, K. K., Muduli, K. K., Luhach, A. Kr., & Poonia, R. C. (2021). Pandemic COVID-19: An empirical analysis of impact on Indian higher education system. *Journal of Statistics and Management Systems*, *24*(2), 341–355. https://doi.org/10.1080/09720510.2021.1875571

Schmitt, J., Fini, M. I., Bailer, C., Fritsch, R., & Andrade, D. F. de. (2020). WWH-dropout scale: when, why and how to measure propensity to drop out of undergraduate courses. *Journal of Applied Research in Higher Education*, *13*(2), 540–560. https://doi.org/10.1108/JARHE-01-2020-0019

Sedgwick, P. (2014). Cross sectional studies: advantages and disadvantages. *BMJ*, *348*(mar26 2), g2276–g2276. https://doi.org/10.1136/bmj.g2276

Segovia-García, N., & Said-Hung, E. (2021). Factores de satisfacción de los alumnos en e-learning en Colombia. *Revista Mexicana de Investigación Educativa*, *26*(89), 595–621.

Segovia-García, N., Said-Hung, E., & Aguilera, F. J. G. (2022). Educación superior virtual en Colombia: factores asociados al abandono. *Educación XX1*, *25*(1), 197–218. https://doi.org/10.5944/eduxx1.30455

Semke, C. A., & Sheridan, S. M. (2012). Family–school connections in rural educational settings: A systematic review of the empirical literature. *The School Community Journal, 22*(1), 21–48.

Silva, R. (1989). La Educación en Colombia, 1880 – 1930. In *Nueva Historia de Colombia* (pp. 211-262). Editorial Planeta.

Singer, J. D., & Willett, J. B. (1993). It's about time: using- discrete-time survival analysis to study duration and the timing of events. *Journal of Educational Statistics*, *18*(2), 155-195.

Smith-Greenaway, E. (2020). Does Parents' Union Instability Disrupt Intergenerational Advantage? An Analysis of Sub-Saharan Africa. *Demography*, *57*(2), 445–473. https://doi.org/https://doi.org/10.1007/s13524-019-00854-7

Snyder, T. D., & Dillow, S. A. (2010). *Digest of Education Statistics, 2009. NCES 2010-013*. National Center for Education Statistics. https://eric.ed.gov/?id=ED509883

Sobaih, A. E. E., Hasanein, A. M., & Abu Elnasr, A. E. (2020). Responses to COVID-19 in Higher Education: Social Media Usage for Sustaining Formal Academic Communication in Developing Countries. *Sustainability*, *12*(16), 6520. https://doi.org/10.3390/su12166520

Soons, J. P. M., Liefbroer, A. C., & Kalmijn, M. (2009). The Long-Term Consequences of Relationship Formation for Subjective Well-Being. *Journal of Marriage and Family*, *71*(5), 1254–1270. https://doi.org/10.1111/j.1741-3737.2009.00667.x

Sosu, E. M., & Pheunpha, P. (2019). Trajectory of University Dropout: Investigating the Cumulative Effect of Academic Vulnerability and Proximity to Family Support. *Frontiers in Education*, *4*, 6. https://doi.org/10.3389/feduc.2019.00006

SPADIES. (2020). *SPADIES 3.0* [base de datos]. https://spadies3.mineducacion.gov.co

Spady, W. G. (1970). Dropouts from higher education: An interdisciplinary review and synthesis. *Interchange*, *1*(1), 64–85. https://doi.org/10.1007/BF02214313

Sterman, J. D. (2001). System Dynamics Modeling: Tools for Learning in a Complex World. *California Management Review*, *43*(4), 8–25. https://doi.org/10.2307/41166098

Stewart, S., Lim, D. H., & Kim, J. (2015). Factors Influencing College Persistence for First-Time Students. *Journal of Developmental Education*, *38*(3), 12–20. https://www.jstor.org/stable/24614019

Stoessel, K., Ihme, T. A., Barbarino, M.-L., Fisseler, B., & Stürmer, S. (2015). Sociodemographic Diversity and Distance Education: Who Drops Out from Academic Programs and Why? *Research in Higher Education*, *56*(3), 228–246. https://doi.org/10.1007/s11162-014-9343-x

Suhendra, I. (2020). Determinan Modal Manusia Di Indonesia: Menggunakan Estimasi Panel. *Jurnal Riset Bisnis Dan Manajemen Tirtayasa*, *4*(2), 162–177. https://doi.org/http://dx.doi.org/10.48181/jrbmt.v4i2.10490

Swail, W. S., Redd, K. E., & Perna, L. W. (2003). *Retaining minority students in higher education: A framework for success*. Wiley Periodicals, Inc.

Tan, P.-N., Steinbach, M., Karpatne, A., & Kumar, V. (2019). *Introduction to data mining* (Second edition). Pearson.

Teuber, Z., Jia, H., & Niewöhner, T. (2021). Satisfying Students' Psychological Needs During the COVID-19 Outbreak in German Higher Education Institutions. *Frontiers in Education*, *6*, 679695. https://doi.org/10.3389/feduc.2021.679695

The World Bank. (2017). *At a Crossroads Higher Education in Latin America and the Caribbean*. The World Bank .

Tinto, V. (1975). Dropout from Higher Education: A Theoretical Synthesis of Recent Research. *Review of Educational Research*, *45*(1), 89–125. https://doi.org/10.3102/00346543045001089

Tinto, V. (1987). *Leaving college: Rethinking the causes and cures of student attrition* (1st ed.). University of Chicago Press.

Tinton, V., & Cullen, J. (1973). *Dropout in higher education: a review and theoretical synthesis of recent research*. Office of Education (DHEW). https://files.eric.ed.gov/fulltext/ED078802.pdf

Trahar, S., Timmis, S., Lucas, L., & Naidoo, K. (2020). Rurality and access to higher education. *Compare: A Journal of Comparative and International Education*, *50*(7), 929–942. https://doi.org/10.1080/03057925.2020.1810895

Troester-Trate, K. E. (2020). Food Insecurity, Inadequate Childcare, & Transportation Disadvantage: Student Retention and Persistence of Community College Students. *Community College Journal of Research and Practice*, *44*(8), 608–622. https://doi.org/10.1080/10668926.2019.1627956

UNESCO. (2020). *Education post-COVID-19: Extraordinary session of the Global Education Meeting (2020 GEM)*. UNESCO. https://en.unesco.org/sites/default/files/gem2020-extraordinary-session-background-document-en.pdf

United Nations Development Programme. (2015). *ODS En Colombia: Los Retos Para 2030*. UNDP.

United Nations. (2021). *Reducing Poverty and Inequality in Rural Areas: Key to Inclusive Development*. United Nations.

Van Bragt, C. A. C., Bakx, A. W. E. A., Teune, P. J., Bergen, T. C. M., & Croon, M. A. (2011). Why students withdraw or continue their educational careers: a closer look at differences in study approaches and personal reasons. *Journal of Vocational Education & Training*, *63*(2), 217–233. https://doi.org/10.1080/13636820.2011.567463

Velázquez, Y., & González, M. A. (2017). Factores asociados a la permanencia de estudiantes universitarios: caso uamm-uat. *Revista de la Educación Superior*, *46*(184), 117–138. https://doi.org/10.1016/j.resu.2017.11.003

Venegas-Muggli, J. I. (2020). Higher education dropout of non-traditional mature freshmen: the role of sociodemographic characteristics. *Studies in Continuing Education*, *42*(3), 316–332. https://doi.org/10.1080/0158037X.2019.1652157

Vera, L. M., Niño, J. A., Porras, A. M., Durán, J. N., Delgado, P. A., Caballero, M. C., & Rueda, J. N. (2020). Salud mental y deserción en una población universitaria con bajo rendimiento

académico. *Revista Virtual Universidad Católica del Norte*, *60*, 137–158. https://doi.org/10.35575/rvucn.n60a8

Voelkle, M. C., & Sander, N. (2008). University Dropout: A Structural Equation Approach to Discrete-Time Survival Analysis. *Journal of Individual Differences*, *29*(3), 134–147. https://doi.org/10.1027/1614-0001.29.3.134

Vooren, M., Haelermans, C., Groot, W., & van den Brink, H. M. (2022). Comparing success of female students to their male counterparts in the STEM fields: an empirical analysis from enrollment until graduation using longitudinal register data. *International Journal of STEM Education*, *9*(1), 1. https://doi.org/10.1186/s40594-021-00318-8

Wang, C. J., Ng, C. Y., & Brook, R. H. (2020). Response to COVID-19 in Taiwan: Big Data Analytics, New Technology, and Proactive Testing. *JAMA*, *323*(14), 1341. https://doi.org/10.1001/jama.2020.3151

Warner, L. (1993). WIST — A science and technology access programme for rural women: The determinants of success. *Distance Education*, *14*(1), 85–96. https://doi.org/10.1080/0158791930140107

Warner, L. (1993). WIST — A science and technology access programme for rural women: The determinants of success. *Distance Education*, *14*(1), 85–96. https://doi.org/10.1080/0158791930140107

Webber, D. A., & Ehrenberg, R. (2009). *Do expenditures other than instructional expenditures affect graduation and persistence rates in American higher education?* Cornell Higher.

Wheat, J. R., Brandon, J. E., Carter, L. R., Leeper, J. D., & Jackson, J. R. (2003). Premedical Education: The Contribution of Small Local Colleges. *The Journal of Rural Health*, *19*(2), 181–189. https://doi.org/10.1111/j.1748-0361.2003.tb00560.x

World Bank. (2020). *The Impact of the COVID-19 Pandemic on Education Financing* [Text/HTML]. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/479041589318526060/The-Impact-of-the-COVID-19-Pandemic-on-Education-Financing

World Bank. (2021). *Global economic prospects*. World Bank Publications.

Xavier, M., & Meneses, J. (2020). A Literature Review on the Definitions of Dropout in Online Higher Education. EDEN Conference Proceedings, 1, 73–80. https://doi.org/10.38069/edenconf-2020-ac0004

Yanow, D. (2007). Interpretation in policy analysis: On methods and practice. *Critical Policy Studies*, *1*(1), 110–122. https://doi.org/10.1080/19460171.2007.9518511

Yasmin. (2013). Application of the classification tree model in predicting learner dropout behaviour in open and distance learning. *Distance Education*, *34*(2), 218–231. https://doi.org/10.1080/01587919.2013.793642

Yepes, F. L., Beltrán, M., & Martínez Ceferino, E. Y. (2017). Academic dropout among undergraduate students from Universidad de Antioquia school of dentistry, 2004–20141.

Revista Facultad de Odontología, *29*(1), 76–95. https://doi.org/10.17533/udea.rfo.v29n1a5

Yiu, L., & Yun, L. (2017). China's Rural Education: Chinese Migrant Children and Left-Behind Children. *Chinese Education & Society*, *50*(4), 307–314. https://doi.org/10.1080/10611932.2017.1382128

Zuñiga, M. G. (2006). *Deserción estudiantil en el nivel superior* (1st ed.). Trillas.