



## Use of Delphi-AHP neutrosophic methods for the analysis of school indicators

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**Abstract.** The study addresses the complex task of analyzing school indicators through the combined application of the Delphi-AHP neutrosophic methods, seeking to overcome the limitations of traditional approaches in educational assessment. The research focuses on the urgent need to develop more robust models that can handle the uncertainty, imprecision, and ambiguity inherent in educational data. Although previous research has been conducted on the analysis of school indicators, conventional approaches fail to effectively integrate the multiple dimensions and degree of uncertainty of the data. This study proposes an innovative solution by integrating neutrosophic tools, which allow for a more flexible and detailed analysis of indicators, considering various perspectives and situations. The use of the Delphi-AHP method, complemented by a neutrosophic perspective, allows for capturing the complexity of the educational environment and generating more accurate and realistic assessments. Through a series of consultation and weighting rounds, results were obtained that highlight the importance of factors such as the social context, educational infrastructure and the participation of actors involved in the school process. The findings not only enrich the theoretical field by applying a neutrosophic approach to the analysis of school indicators but also offer practical applications to improve educational policies and decision-making. This study contributes significantly to the advancement of educational data analysis by providing a more adaptable and accurate methodological framework for future research and practice in the school setting.

**Keywords:** Neutrosophic methods, Delphi-AHP, School indicator analysis, Data uncertainty, Evaluation models, Decision making, Data analysis.

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### 1 Introduction

Education is an inalienable right, and access to it is guaranteed by the Ecuadorian State, that is, the constitutional norm contemplates its application under the principles of equity, equality, solidarity, and justice [1]. The Ecuadorian Constitution guarantees the right to education by the State, which should promote public policies and execute programs and projects financed with public funds, promoting the schooling of all citizens.

Education is a fundamental human right and is essential for progress. It allows all human beings to live a healthy, creative and meaningful existence. It is a catalyst that seeks to consolidate inclusive societies from university spaces, not only by declaring it valuable in institutional documents but also by training professionals capable of making decisions and facing the complexity of life in society [2]. The educational transformation is achieving inclusive, renewed and quality education. Although significant changes have been achieved, much remains to be done for the district to have one of the quality educational systems. To this end, the interaction and co-responsibility of the State and the

educational community are essential. The Ministry of Education, based on quality standards, implements the work of educational auditing to make visible the educational development in the territory in coherence with the constitutional principle of Good Living and the sustainable development of the comprehensive training of children, youth and adults.

Education helps human beings to become autonomous, to have a better quality of life, to make decisions and to be supportive. People have the right not only to access education, but also to access quality education oriented towards fundamental values such as humanism, justice, respect for diversity, education for peace and sustainable development. States shall promote international cooperation in education to contribute to the elimination of ignorance and illiteracy throughout the world and to facilitate access to technical knowledge and modern teaching methods. In this regard, special account shall be taken of the needs of developing countries.

In the Ecuadorian context, school dropout has been identified as a problem that demands urgent attention and effective measures from authorities, educators, the community and society in general. It is important to understand the causes and consequences of school dropout to address it comprehensively and develop strategies that promote equitable and sustainable education. School dropout in children and adolescents is a phenomenon that affects the integral development of the individual because it does not allow them to continue with their academic training. It has the characteristic of being multi-causal and causes a mismatch between age and educational level or definitive abandonment.

School dropout in Ecuador is a problem that harms the efficiency of the educational system in low-income sectors and the rural population. One of the factors is the economic part, determined by the lack of permanent employment, which is sometimes the result of a lack of studies. Various investigations show that the causes of school dropout are due to multifactorial reasons that range from personal, family and economic aspects to political, cultural and institutional ones.

Dropping out of school is an act that leads to neglecting studies or enrolling in another institution and is considered school abandonment when the priority is not to study but to meet obligations that are satisfied with various human needs. In other words, school abandonment is determined by statistical figures related to the number of students who drop out of school from one school year to the next.

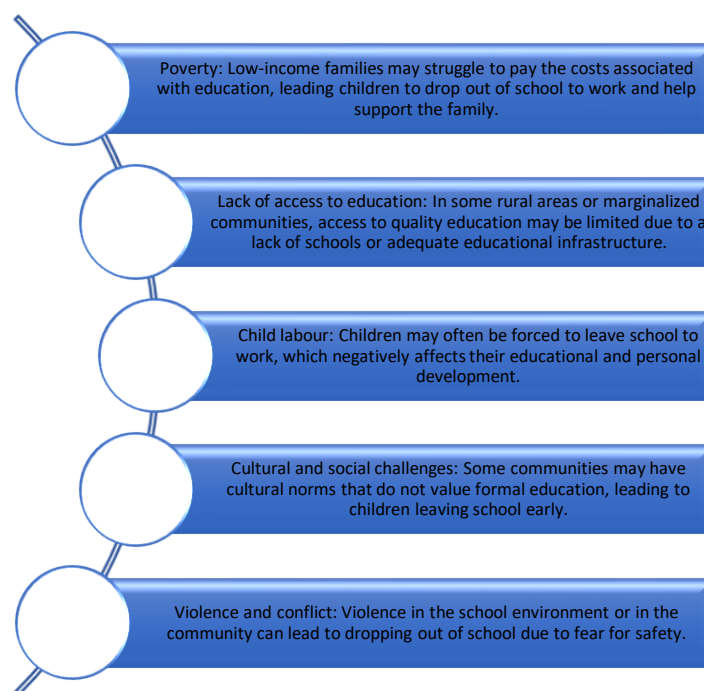


Figure 1. Causes of school dropout. Source: Own elaboration.

Poverty and lack of access to basic resources are determining factors in the phenomenon of school dropout. In many regions of Ecuador, especially in rural areas and marginalized communities, families face economic difficulties that directly affect the educational continuity of their children. The high costs associated with education, such as uniforms, books and school supplies, as well as transportation expenses, can become insurmountable barriers for many low-income families.

Similarly, the need to contribute to family income and child labour are painful realities that force many children to abandon their studies in search of employment to help their families survive. This situation not only negatively impacts their academic development but also limits their future opportunities and perpetuates the cycle of poverty.

School dropout can also be linked to cultural challenges rooted in certain communities, where formal education is not always valued or prioritized. Cultural norms and traditions can encourage children and adolescents to drop out of school early, creating a worrying educational gap. Furthermore, violence in the school environment and in the community can be an important reason for school dropout. Insecurity and fear of physical or psychological aggression can lead students to avoid school and affect their emotional well-being and their ability to learn in a safe and supportive environment.

Young people lose the opportunity to acquire knowledge with which they can get by in life, which directly causes a high unemployment rate, as they cannot apply this knowledge to perform a specific task. This situation endangers the future of the country, because if there are no young people with the basic knowledge that can only be learned in schools and colleges, it will be very difficult for them to develop other technical skills due to all the time wasted in non-educational activities [3].

The Constitution of the Republic of Ecuador sets out objectives to progressively improve the quality of education, from a rights-based, gender-based, intercultural and inclusive approach, to strengthen unity in diversity and, above all, to guarantee the permanence and completion of studies, as well as to examine other forms of diversity, analyzing the capacity of each person to build relationships of coexistence, equity, dialogue and creativity, but there is still much to be done.

From the perspective of interculturality, it is of utmost importance to understand the diversity of cultures that coexist in the same territory, the worldview and the social needs for full development. In this framework, the right to have educational systems relevant to knowledge, language and reality is recognized, taking into account the diversity that postulates the interculturality of the territories in the process of integration.

School dropout is also an expression of educational inequality and the conditions that compulsory schooling assumes, considering that various intra-family factors have a unique impact on each student when continuing their higher education. It is necessary to demonstrate the relevance of involving the entire community in rethinking education as a need and a right established for Ecuadorians. In this way, it is possible to demand from state and institutional bodies norms and public policies that encourage and support all individuals to continue their path towards education from a culturally appropriate logic that knows how to attend to the needs of peoples and nationalities, rethinking the school format to promote greater educational inclusion.

In many Latin American countries, public education represents the majority of educational services offered. There are approximately 9 times more children in public education than in private education. Thus, differences can be observed between both types of education: in coverage, performance, infrastructure and teachers. The differences become more marked when observed by geographic area.

Education is a relevant intermediary for obtaining means, such as the acquisition and transfer of a good social level and lifestyle, and at the same time, it transforms the community where it is located. Therefore, various educational methods explore ways to prevent school dropouts and fulfill the purpose of students completing their studies satisfactorily and projecting themselves beyond. Based on the above, the general objective of this study is: to analyze the causes of school dropouts [4].

Specific objectives:

- To investigate the main socioeconomic causes of school dropouts among children and adolescents in Ecuador.

- Identify the factors that may influence the decision to drop out of school.
- Propose educational strategies and policies that effectively address the identified causes of school dropout, with special attention to measures to reduce poverty and improve access to educational resources, as well as awareness-raising and sensitization campaigns on the importance of education.

### 1. Neutrosophic Delphi Method

The Delphi technique is used in many fields such as program planning, resource utilization, policy analysis, and needs assessment. The Delphi technique has the following advantages:

1. Addressing complex problems effectively.
2. Able to define and modify a wide range of alternatives.
3. Create different judgments about the same issue and use feedback on individual judgments to allow people to revise their views.
4. Achieve a high degree of consensus.
5. Increase coherence by reducing the noise that results from focusing on group and/or individual interests rather than focusing on problem-solving.

This is a structured communication technique designed primarily to gather and consolidate expert opinions on specific topics through a series of iterative questionnaires with controlled feedback. Developed in the 1950s by the RAND Corporation, this method is used to reach consensus on predicting future trends, solving complex problems, strategic planning, and risk assessment, among others.

The process begins with the selection of a panel of experts who possess specialized knowledge in the area of interest. These experts respond to an initial questionnaire, the answers to which are anonymized and summarized by a coordinator or coordinating team. The summarized results are then shared with the group, along with a new questionnaire based on the previous responses. This questionnaire-response-feedback process is repeated in several rounds, to narrow the range of responses and move the group toward consensus.

A key feature of the Delphi method is the anonymity of participants, which helps to avoid the influence or dominance effect of some participants over others, thus facilitating more objective responses and reducing conformity bias. At the end of the process, the convergence of opinions is expected to reveal a consensus or a clearer understanding of the issue at hand, providing valuable information for decision-making [5].

To establish the knowledge of the analyzed topic and the object of study, a self-assessment process is carried out on a scale (see Table 1). This so-called neutrosophic knowledge coefficient is determined from the information that the expert himself presents on the object of study.

**Table 1:** Linguistic terms used.

Linguistic term	SVNN
Full knowledge of the object of study (FK)	(1,0,0)
Very very good in the subject of study (VVGK)	(0.9, 0.1, 0.1)
Very good in the subject of study (VGK)	(0.8,0.15,0.20)
Good in the subject of study (GK)	(0.70,0.25,0.30)
Moderately good in the subject of study (MGK)	(0.60,0.35,0.40)
Know the topic of study (K)	(0.50,0.50,0.50)
Has moderately poor knowledge of the subject matter (MPK)	(0.40,0.65,0.60)
Little knowledge of the subject of study (PK)	(0.30,0.75,0.70)
Knows very little about the subject of study (VPK)	(0.20,0.85,0.80)

Linguistic term	SVNN
Very, very poor knowledge of the subject of study (VVPK)	(0,10,0,90,0,90)
Without knowledge of the subject of study (NK)	(0,1,1)

For the evaluation and validation of the questionnaires through the Delphi method, the scale (see Table 2) was used to achieve greater objectivity in the management of information, which allows the evaluation of the criteria argued by the judges of the panel of experts for each of the items individually. Through linguistic terms with Single-valued Neutrosophic Numbers (SVNN) for consensus based on the expert's opinion, criteria are evaluated using the neutrosophic argumentation coefficient.

**Table 2:** Linguistic terms used.

Linguistic term I	SVNN	Linguistic term II
Very suitable (VA)	(0,9,0,1,0,1)	Essential (E)
Fairly adequate (FA)	(0.75,0.25,0.20)	Very useful (VU)
Suitable (A)	(0.50,0.55,0.5)	Useful (U)
Poorly Adequate (PA)	(0.3,0.75,0.80)	Not Very Useful (LU)
Not suitable (NA)	(0,10,0,90,0,90)	Not useful (NU)

To determine the consensus among the participants of the expert panel, the coefficient of agreement was used, determined through the expression:

$$Cc = \left(1 - \frac{V_n}{V_t}\right) 100 \tag{1}$$

Where:  $V_n$  is the number of negative votes cast by the judges, and  $V_t$  is the total number of votes cast by the judges. Therefore, a level of consensus must be reached when the coefficient of agreement  $Cc$  obtains a value greater than 75%, and the process must be concluded; if this value is not reached, a new round must be established.

## 2. Neutrosophic AHP method

The Analytic Hierarchy Process (AHP) is a theory-oriented to the decision-maker and is used to identify the best alternative according to the assigned resources. This method can be applied to situations that involve technical, economic, political, social and cultural factors. That is, it aims to be a scientific tool to address aspects that are difficult to quantify but that sometimes require a unit of measurement. The methodology in its original version can be seen in [11]. However, for this work the need for uncertainty is recognized, and for this purpose its neutrosophic version is adopted, which uses triangular numbers for its execution, whose definition is the following:

**Definition 1:** Let  $X$  be a space of points and  $x \in X$ . A neutrosophic set  $A$  in  $X$  is defined by a truth membership function  $T_A(x)$ , an indeterminacy membership function  $I_A(x)$ , and a falsity membership function  $F_A(x)$ .  $U$  is the Universe of Discourse and  $\forall x \in U, T_A(x), I_A(x), F_A(x) \subseteq ]-0, 1+[ , y -0 \leq \inf T_A(x) + \inf I_A(x) + \inf F_A(x) \leq \sup T_A(x) + \sup I_A(x) + \sup F_A(x) \leq 3+$ . Note that by the definition,  $T_A(x), I_A(x)$ , and  $F_A(x)$  are standard or nonstandard real subsets of  $] -0, 1+[$  and hence  $T_A(x), I_A(x)$ , and  $F_A(x)$  can be subintervals of  $[0, 1]$  [6].

**Definition 2:** Let  $X$  be a universe of discourse. A single-valued neutrosophic set  $A$  over  $X$  is an object taking the form  $A = \{ \langle x; T_A(x), I_A(x), F_A(x) \rangle : x \in U \}$ , where  $T_A : U \rightarrow [0, 1]$ ,  $I_A : U \rightarrow [0, 1]$  and  $F_A : U \rightarrow [0, 1]$ ,  $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$  for all  $x \in X$ . The intervals  $T_A(x)$ ,  $I_A(x)$ , and  $F_A(x)$  represent the degree of truth, degree of indeterminacy, and degree of falsehood of  $x$  through  $A$ , respectively. For convenience, an SVN number is represented by  $A = (a, b, c)$ , where  $a, b, c \in [0, 1]$  and  $a+b+c \leq 3$ .

**Definition 3:** Suppose  $\tilde{a}, \tilde{a}, \tilde{a} \in [0, 1]$  and  $a_1, a_2, a_3, a_4 \in \mathbb{R}$  where  $a_1 \leq a_2 \leq a_3 \leq a_4$ . Then, a single-valued trapezoidal neutrosophic number,  $\tilde{a} = \langle (a_1, a_2, a_3, a_4); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle$ , is a special neutrosophic set in the real line set  $\mathbb{R}$ , whose truth membership, indeterminacy membership and falsity membership functions are defined as see the revised methodology [7, 8]

**Definition 4:** Given  $\tilde{a} = \langle (a_1, a_2, a_3, a_4); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle$  two  $\tilde{b} = \langle (b_1, b_2, b_3, b_4); \alpha_{\tilde{b}}, \beta_{\tilde{b}}, \gamma_{\tilde{b}} \rangle$  single-valued trapezoidal neutrosophic numbers and  $\lambda$  any nonzero number on the real line, the following operations are defined:

Addition:  $\tilde{a} + \tilde{b} = \langle (a_1 + b_1, a_2 + b_2, a_3 + b_3, a_4 + b_4); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle$

Remaining:  $\tilde{a} - \tilde{b} = \langle (a_1 - b_4, a_2 - b_3, a_3 - b_2, a_4 - b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle (2)$

Investment:  $\tilde{a}^{-1} = \langle (a_4^{-1}, a_3^{-1}, a_2^{-1}, a_1^{-1}); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle$ , where  $a_1, a_2, a_3, a_4 \neq 0$ .

Multiplication by a scalar number: [9]

This technique models the problem leading to the formation of a representative hierarchy of the associated decision-making scheme. The comparison is made using a scale, according to Table 3. To verify the neutrosophic methodology see [6-10].

**Table 3.** Saaty scale translated into a neutrosophic triangular scale. Source: [11, 12, 13]

The Saaty scale	Definition	Neutrosophic triangular scale
1	Equally influential	$\langle (1, 1, 1); 0.50, 0.50, 0.50 \rangle$
3	Slightly influential	$\langle (2, 3, 4); 0.30, 0.75, 0.70 \rangle$
5	Strongly influential	$\langle (4, 5, 6); 0.80, 0.15, 0.20 \rangle$
7	Very strongly influential	$\langle (6, 7, 8); 0.90, 0.10, 0.10 \rangle$
9	Absolutely influential	$\langle (9, 9, 9); 1.00, 1.00, 1.00 \rangle$
2, 4, 6, 8	Sporadic values between two close scales	$\langle (1, 2, 3); 0.40, 0.65, 0.60 \rangle$ $\langle (3, 4, 5); 0.60, 0.35, 0.40 \rangle$ $\langle (5, 6, 7); 0.70, 0.25, 0.30 \rangle$ $\langle (7, 8, 9); 0.85, 0.10, 0.15 \rangle$

### 3. Information processing and results

The Delphi methodology is based on an iterative process of rounds of questionnaires sent to a panel of experts. The idea is that, through several rounds, a closer consensus is reached on the issue in question. In the context of factors involved in school dropout, this process would involve asking experts to evaluate and discuss the relative importance of each factor and how they interact with each other [14, 15, 16].

#### Round 1: Determination of factors

Below are six factors that influence school dropout:

1. Economic: Lack of permanent employment, often a result of lack of education, negatively impacts the ability to continue education.
2. Personal: Individual aspects of students that may influence their decision to drop out of school.

3. Family: Circumstances of the family environment that may affect the educational continuity of children and adolescents.
4. Political: Public policies and government management of education can have a direct impact on the school dropout rate.
5. Institutional: Factors related to the quality of education, inclusion and the efficiency of the educational system in general.
6. Cultural: Cultural values, beliefs and practices can influence perceptions of education and, therefore, school dropout rates.

**Round 2: Identification of key factors and initial assessments**

**Questions:**

1. What do you think is the impact of economic factors on school dropouts?
2. Evaluate the impact of personal factors on school dropout.
3. To determine the influence of family factors on school dropouts.
4. Evaluate the importance of political factors in school dropouts.
5. Indicate how cultural factors affect school dropouts.
6. What is the impact of institutional factors on school dropout?

**Answers:**

Experts provide their assessments based on their knowledge and experience. These responses are compiled and analyzed to identify areas of consensus and disagreement.

**Table 5:** Level of validation of criteria.

Expert	Economic	Staff	Family	Political	Cultural	Institutional
E1	(0.35; 0.75; 0.80)	(0.50;0.5;0.50)	(0.75; 0.25; 0.20)	(0.75; 0.25; 0.20)	(0.35; 0.75; 0.80)	(0.50;0.5;0.50)
E2	(0.9;0.1;0.1)	(0.10;0.90;0.90)	(0.75; 0.25; 0.20)	(0.75; 0.25; 0.20)	(0.9;0.1;0.1)	(0.10;0.90;0.90)
E9	(0.10;0.90;0.90)	(0.10;0.90;0.90)	(0.9;0.1;0.1)	(0.10;0.90;0.90)	(0.10;0.90;0.90)	(0.10;0.90;0.90)
E16	(0.35;0.75;0.80)	(0.50;0.5;0.50)	(0.10;0.90;0.90)	(0.35;0.75;0.80)	(0.75;0.25;0.20)	(0.10;0.90;0.90)
E23	(0.75;0.25;0.20)	(0.35;0.75;0.80)	(0.10;0.90;0.90)	(0.75;0.25;0.20)	(0.35;0.75;0.80)	(0.50;0.5;0.50)
E27	(0.9;0.1;0.1)	(0.10;0.90;0.90)	(0.9;0.1;0.1)	(0.35;0.75;0.80)	(0.10;0.90;0.90)	(0.75;0.25;0.20)
E34	(0.35;0.75;0.80)	(0.35;0.75;0.80)	(0.10;0.90;0.90)	(0.9;0.1;0.1)	(0.75;0.25;0.20)	(0.35;0.75;0.80)
E39	(0.50;0.5;0.50)	(0.50;0.5;0.50)	(0.9;0.1;0.1)	(0.35;0.75;0.80)	(0.9;0.1;0.1)	(0.75;0.25;0.20)
E42	(0.75;0.25;0.20)	(0.9;0.1;0.1)	(0.10;0.90;0.90)	(0.50;0.5;0.50)	(0.75;0.25;0.20)	(0.10;0.90;0.90)
E62	(0.35;0.75;0.80)	(0.50;0.5;0.50)	(0.50;0.5;0.50)	(0.35;0.75;0.80)	(0.75;0.25;0.20)	(0.75;0.25;0.20)
E70	(0.10;0.90;0.90)	(0.50;0.5;0.50)	(0.35; 0.75; 0.80)	(0.10;0.90;0.90)	(0.35; 0.75; 0.80)	(0.35; 0.75; 0.80)
E80	(0.50;0.5;0.50)	(0.50;0.5;0.50)	(0.50;0.5;0.50)	(0.9;0.1;0.1)	(0.35; 0.75; 0.80)	(0.10;0.90;0.90)

**Table 6:** Neutrosophic relative frequency.

INDICATORS	(0.9;0.1;0.1)	(0.75; 0.25; 0.20)	(0.50;0.5;0.50)	(0.35; 0.75; 0.80)	(0.10;0.90;0.90)
Economic	0.1667	0.3333	0.5000	0.8333	1,0000
Staff	0.0833	0.0833	0.5833	0.7500	1,0000
Family	0.2500	0.4167	0.5833	0.6667	1,0000
Political	0.1667	0.4167	0.5000	0.8333	1,0000
Cultural	0.1667	0.5000	0.5000	0.8333	1,0000
Institutional	0.0000	0.2500	0.4167	0.5833	1,0000

**Table 7:** Cut-off points and criteria scale.

N - Average.	SVNN
-1.13	Useful
-0.84	Not very useful
-1.17	Useful
-1.18	Useful
-1.22	Useful
-0.39	Not very useful

### Round 3: Refining the assessments

Based on the responses from Round 2, a summary of the assessments is produced and areas of agreement and disagreement are identified. Clarifications are sought and experts are asked to reconsider their previous responses if they deem it necessary, especially in areas where there was significant disagreement.

#### Questions:

1. Given the variety of responses on the impact of economic factors, would you like to modify your assessment?
2. Are there any new considerations you would like to add regarding the impact of personal factors?
3. Given the variety of opinions on family factors, do you think your assessment needs to be adjusted?
4. How would you evaluate the importance of political factors after seeing the responses of other experts?
5. Based on the feedback received, would you modify your perception of cultural factors?
6. Are there arguments that lead you to change your assessment of institutional factors?

#### Answers:

Experts review their previous assessments and adjust them based on discussions and arguments presented by other participants.

### Round 4 (and subsequent rounds if necessary): Consensus

If significant discrepancies still exist, another round is held focusing on the points of disagreement. Responses are obtained and the experts reach a consensus.



### Conclusion of the Delphi process

At the end of the Delphi process [17], a final report is produced that summarizes the consensus reached, highlighting the factors of school dropout considered most critical by the panel of experts, as well as their interrelations and impacts. This report can serve as a basis for decision-making and the development of solutions aimed at minimizing school dropout.

It is found that the factor that most influences school dropout and the right to education is the institutional problem, which brings with it a lack of quality in education, inclusion and low efficiency of the educational system in general.

Considering that the institutional problem, characterized by the lack of educational quality, insufficient inclusion and limited efficiency of the educational system, is identified as the main factor in school dropouts, the following solutions are proposed to effectively address this problem.

### Solutions to address the institutional problem:

**Improving Educational Infrastructure and Resources:** Investing in modernizing school infrastructure and providing adequate educational resources. In addition, including educational technology that facilitates interactive and modern learning, accessible to all students.

**Continuous teacher training and development:** Implement continuous professional development programs for teachers, focused on inclusive and effective teaching methodologies, diversity management in the classroom, and updates on disciplinary content to ensure quality education.

**Inclusion and student support policies:** Develop and implement inclusion policies that address the needs of all students, especially those belonging to vulnerable groups. This includes support and tutoring programs, curricular adaptations for special needs, and strategies to encourage active student participation in their educational process.

### Strategies for applying the AHP method to solve the problem:

1. Promotion of Educational Inclusion Policies and Programs (PP)
2. Implementation of Educational Quality Improvement Programs (PI)
3. Strengthening Teacher Training and Professional Development (FF)
4. Optimization of Management and Efficiency of the Educational System (OG)

**Table 8.** Neutrosophic AHP paired matrix [18]

Strategies	PP	PI	FF	OG
PP	1	$\langle (4,5,6);0,80,0,15,0,20 \rangle$	$\langle (6,7,8);0,90,0,10,0,10 \rangle$	$\langle (6,7,8);0,90,0,10,0,10 \rangle$
PI	$1/ \langle (4,5,6);0,80,0,15,0,20 \rangle$	1	$\langle (2,3,4);0,30,0,75,0,70 \rangle$	$\langle (4,5,6);0,80,0,15,0,20 \rangle$
FF	$1/ \langle (6,7,8);0,90,0,10,0,10 \rangle$	$1/ \langle (2,3,4);0,30,0,75,0,70 \rangle$	1	$\langle (2,3,4);0,30,0,75,0,70 \rangle$
OG	$1/ \langle (6,7,8);0,90,0,10,0,10 \rangle$	$1/ \langle (4,5,6);0,80,0,15,0,20 \rangle$	$1/ \langle (2,3,4);0,30,0,75,0,70 \rangle$	1

**Table 9.** Criterion weights using the Neutrosophic AHP method.

Strategies	PP	PI	FF	OG	Weight
PP	0.67	0.77	0.62	0.44	0.62
PI	0.13	0.15	0.26	0.31	0.22
FF	0.10	0.05	0.09	0.19	0.11
OG	0.10	0.03	0.03	0.06	0.05

It is concluded that the inclusion and equity strategy is the one that has the greatest weight, so specific policies and programs must be implemented that promote inclusion and equity in the educational system, targeting vulnerable groups and those at risk of dropping out of school. This may include scholarship programs, psychosocial support, tutoring and mentoring services, and curricular adaptations for students with special educational needs. The objective is to ensure that each student has access to quality education and learning opportunities appropriate to their circumstances.

### A. Discussion

To address the problem of school dropouts in Ecuador, it is necessary to implement policies and programs that focus on:

- Ensure universal access to free, quality education.
- Implement scholarship or incentive programs to help low-income families keep their children in school.
- Raise community awareness about the importance of education and change cultural perceptions that may affect school attendance.
- Create safe and violence-free school environments.
- Provide support and educational opportunities for teenage mothers.
- Both the government and society must work together to address this issue and ensure that all children and adolescents in Ecuador have equal opportunities to access and remain in the education system.

To prevent or reduce school dropout among children and adolescents in Ecuador, it is necessary to implement a series of recommendations and strategies that address the various causes of the problem. Below are some key recommendations:

1. Establish scholarship and financial aid programs targeted at low-income students and families to cover education-related expenses such as school supplies, uniforms, and transportation. This will help reduce the economic barrier that leads many children to leave school to work.
2. Ensure equal access to educational resources, including textbooks, teaching materials and technology, especially in rural and marginalized communities, to facilitate the learning process and encourage school retention.
3. Implement school feeding programs that ensure adequate nutrition for students. Poor nutrition can affect academic performance and class attendance, and such a program can be an incentive for children to attend school regularly.
4. Conduct awareness campaigns on the importance of education and the risks associated with school dropout. Involve the community and parents in the educational process, highlighting their role in supporting and monitoring their children's education.

5. Provide training for teachers to identify warning signs and risk factors in students who may be at risk of dropping out of school. It is also critical that teachers are trained to offer emotional and academic support to students who need it.
6. Implement tutoring and mentoring programs between students of different grades or between students and community professionals. This can foster motivation and a sense of belonging to the school, while providing a space for support and guidance for students.
7. Develop strategies to prevent and combat child labour, such as creating support programmes for families and promoting alternatives for generating income that do not affect children's school attendance.
8. Implement policies and programs that address the needs of children and adolescents with disabilities, indigenous populations, migrants and other vulnerable groups, ensuring that they have access to quality education and feel integrated into the educational system.
9. Establish systems to monitor and follow up on student attendance and academic performance to identify dropout patterns and take preventive actions in a timely manner.
10. Promote collaboration between the government, educational institutions, non-governmental organizations, private enterprise and civil society to design and implement comprehensive strategies that address school dropout from multiple perspectives.

## 5. Conclusion

Every public agenda highlights the role of education as a tool for economic development or as a channel for progress, because education is one of the issues that unite public policies throughout the world and is the key to achieving full employment and the eradication of poverty and inequality, and laying the foundations for sustained economic growth. Therefore, it is necessary to maintain inclusion as a fundamental premise, to share and build new educational proposals based on prior knowledge regarding what makes it difficult for children and adolescents to remain in the classroom and, at the same time, to help them carry out a comprehensive analysis of the possibilities to eliminate school dropout.

The use of the Neutrosophic Delphi and AHP methods highlights the importance of implementing inclusive educational policies in the prevention and reduction of school dropout in Ecuador. Educational policies and programs must focus on these key aspects to achieve inclusive and equitable education for all children and adolescents in the country. Therefore, a sustained commitment is required from governments, educational institutions, teachers, families and the community in general, as well as the willingness to invest in the long term to achieve significant and lasting changes in the educational system.

Considering education as a universal right of the population implies that everyone who aspires to study can do so and that the system itself includes it. However, in practice it is known that there are many obstacles to complying with this precept. The responsibility of making a truly inclusive education possible must be shared by all and not fall solely on educational institutions. Providing resources is a responsibility that no government should shirk. It is necessary to create Educational Institutions that approve and value differences and recognize equity and equal opportunities. This implies changes and modifications of content, approaches, structures and strategies based on a common vision.

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