Neutrosophic Analytical Hierarchy Process (NAHP) for Addressing Cyber violence

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Abstract

To address the complex challenges of cyberviolence and gender-based violence among young students, it is crucial to employ analytical approaches that consider the multifaceted nature of these phenomena. The Neutrosophic Analytical Hierarchy (NAHP) method is presented as an innovative tool that allows us to unravel the different layers of influences and factors involved in these behaviors. This approach not only recognizes the diversity of perspectives and experiences that contribute to online and gender-based violence, but also offers a structured framework to assess and prioritize these factors holistically. By applying the NAHP, not only the visible and direct aspects of cyberviolence and gender violence are explored, but also the more subtle and underlying aspects that may go unnoticed in conventional analyses. This method allows us to capture the dynamic complexity of how individual perceptions, social norms, and power dynamics interact to perpetuate these problems in student environments. Thus, a deeper and more nuanced understanding of the triggering and contributing factors is fostered, facilitating the formulation of more effective interventions and policies that are sensitive to the specific needs of affected young people.

Keywords: Cyber violence and Gender Violence; Analytical Hierarchy Process (AHP); Neutrosophic Analytical Hierarchy Process (NAHP)

1. Introduction

Cyber violence, defined as the use of digital technologies to perpetuate acts of psychological, emotional, or physical violence, has emerged as a worrying challenge on the global landscape. Through online platforms and social networks, individuals may be subject to harassment, defamation, or threats that profoundly affect their well-being and safety [1]. In parallel, gender violence, rooted in deeply rooted socio-cultural structures, persists as an insidious form of oppression and discrimination. This form of violence ranges from domestic violence to sexual harassment in public and workplace spaces, perpetuating inequalities and limiting the full exercise of the human rights of women and people of non-binary genders. The intersection of cyberviolence with gender violence amplifies the negative impacts on victims, exacerbating vulnerability and perpetuating cycles of trauma and social exclusion. The anonymous nature and speed of online propagation of these acts increase the difficulty of their detection and effective mitigation [2]. Likewise, the lack of robust legal frameworks and adequate protection mechanisms represents a significant challenge for public policies and judicial systems in

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the digital age. Furthermore, emerging technologies such as artificial intelligence and the Internet of Things introduce new dimensions of risk and complexity in the dynamics of cyberviolence and gender violence. The automation of harassment processes and the misuse of personal data intensify threats to the privacy and security of people, especially those belonging to marginalized and minority groups. It is crucial to recognize that cyber-violence and gender violence not only affect at the individual level, but also have profound socioeconomic and cultural consequences. The perpetuation of gender stereotypes and the normalization of abusive behavior online reflect power imbalances rooted in historical structures of inequality and discrimination [3].

In response to these challenges, it is imperative to strengthen digital education and critical awareness among internet users, promoting practices of respect and responsibility online. Furthermore, coordinated collaboration between governments, civil organizations, and the private sector is required to develop inclusive policies and effective intervention strategies that protect the rights and dignity of all people, regardless of their gender or sexual orientation [4]. Addressing cyberviolence and gender violence in the 21st century demands a comprehensive and multisectoral approach that recognizes the intersectionality of these phenomena and works towards building safe and equitable digital environments. Only through global collaboration and commitment to the principles of social justice and human rights can we hope to create more just and violence-free societies for future generations [5].

2. Related Works

2.1. Cyberviolence and Gender Violence

Digital violence is also called cyber violence and online violence. It involves all forms of aggression and intimidation that are carried out using Information and Communication Technologies (ICT). This expression of violence can take different forms such as [6]:

- Online harassment and stalking: sending abusive, threatening, or degrading messages through social media platforms, email or instant messaging.
- Sharing intimate images and videos without consent: This covers the publication or sharing of sexual or private images or videos without the prior knowledge of the people involved.
- Doxing – This is where sensitive personal information such as address, phone number, or financial data is revealed to harass or cause harm.
- Threats of physical or sexual violence: These include sending messages that threaten to physically hurt or sexually assault someone to scare them.

2.2. Impact on victims

Physical and mental health problems are some of the adverse effects that victims experience because of cyber victimization such as [7-9]:

Anxiety and depression: Continued harassment and threats can cause feelings of anxiety, fear, and hopelessness that lead to depression.

Post-traumatic stress: Victims of cyber violence may develop post-traumatic stress, characterized by flash-backs, nightmares, and difficulty concentrating.

Low self-esteem: Exposure to negative comments and personal attacks can affect the victim's self-esteem, making them feel vulnerable and insecure.

Social isolation: Fear of being a victim of cyber violence can lead victims to socially isolate themselves and avoid participating in online or offline activities.

Suicidal ideation: In extreme cases, cyberviolence can lead to suicidal ideation, especially in young and vulnerable victims.

2.3. Specific forms of cyber violence

Women, girls and LGBTQIA+ people are particularly vulnerable to cyber violence, as they are targeted with specific attacks related to their gender, sexual orientation or gender identity. These forms of cyber violence may include:

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Online sexual violence: This includes sending unsolicited sexually suggestive messages, posting sexually abusive images or videos, and cyberbullying for sexual purposes [10].

Online hate speech: Refers to the spread of messages of hate and discrimination directed at women, girls and LGBTQIA+ people, based on their gender, sexual orientation or gender identity.

Doxing and revenge doxing: Involves the disclosure of personal information of women, girls, and LGBTQIA+ people to harass, threaten, or harm them.

Impersonation: This involves creating false profiles on social networks or other digital platforms to impersonate the victim and damage their reputation.

2.4. Factors that exacerbate cyber violence

Cyber violence is exacerbated by several factors, including [11]:

Online anonymity: the ease of hiding one's identity on digital platforms allows perpetrators to act with impunity and without fear of being identified.

ICT Accessibility: The widespread availability of electronic devices and Internet connectivity facilitates the perpetration of cyber violence.

Lack of legislation and protective measures: In many countries, there are no specific laws criminalizing cyber violence, making it difficult to prosecute perpetrators and protect victims.

Normalization of online violence: Constant exposure to violent content on digital platforms can normalize violence and make it easier for perpetrators to justify their actions.

Cyberviolence is a complex and multifaceted phenomenon that disproportionately affects women, girls and LGBTQIA+ people. It is essential to understand the characteristics, forms of manifestation and factors that exacerbate it to develop effective strategies to prevent and combat it. Collaboration between governments, institutions, civil society organizations and the community at large is crucial to building a safer and more inclusive digital world, where all people can enjoy their rights and freedoms without fear of being victims of violence [12].

2.5. Neutrosophic Set

The conception of neutrosophic sets introduces an intriguing insight into set theory, challenging the traditional dichotomy of true or false by recognizing a third state: the indeterminate. Florentin Smarandache conceived this theory, which holds that a set can contain elements that are clearly true, clearly false, or, crucially, indeterminate, where truth or falsity cannot be determined with absolute certainty. This trichotomous approach reflects the ambiguous and often subjective nature of many phenomena in the real world, where the boundaries between what is true and what is false may be blurred or nonexistent. From a mathematical and philosophical perspective, neutrosophic sets provide a powerful tool for modeling and managing uncertainty. Unlike fuzzy sets, which admit degrees of membership, and intercalary sets, which handle ranges of possible values, neutrosophic sets capture the essence of the ambiguity inherent in many human decisions and judgments. This formalization not only enriches mathematical theory, but also has significant practical applications in fields such as artificial intelligence, where imprecise logic can improve the ability of systems to handle incomplete or contradictory information. A fundamental aspect of neutrosophic sets is their ability to represent reality in a more faithful and nuanced way. In situations where absolute truth is difficult to determine, such as in subjective evaluations or contexts with incomplete or contradictory information, this trichotomous approach offers a framework that can better capture the complexity of the real world. This is especially relevant in areas such as medical decision-making, where diagnoses can be subject to variable interpretations and uncertainty about the effectiveness of treatments.

In addition to their usefulness in mathematical formalization, neutrosophic sets also raise interesting philosophical questions about the nature of knowledge and truth. How do we define truth in situations where certainty is elusive? In addition, how can we manage ambiguity effectively in reasoning and decision-making? These questions invite deep reflection on the limits of human knowledge and on the conceptual tools necessary to confront the growing complexity of the modern world. From a critical perspective, neutrosophic ensembles face challenges and criticism. Some might argue that the introduction of an indeterminate state could unnecessarily complicate set theory, introducing ambiguity where clarity is preferred. However, this criticism underestimates the ability of neutrosophic ensembles to model real phenomena that are inherently ambiguous or uncertain. Rather than simplifying reality, this theory offers a robust tool to capture and analyze the complexity of the world more accurately.

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In terms of practical applications, neutrosophic ensembles have the potential to transform areas such as artificial intelligence, where the ability to manage uncertainty and conflicting information is crucial to improving systems performance. By allowing a more faithful representation of uncertainty in data and automated decisions, this theory could open new frontiers in the development of more adaptive and robust algorithms and systems. Neutrosophic sets represent a significant advance in set theory, offering a trichotomous perspective that overcomes the limitations of traditional binary logic. This theory not only enriches the mathematical and philosophical field, but also promotes a deeper understanding of ambiguity and uncertainty in decision-making and the representation of human knowledge. By integrating this perspective across diverse disciplines, we can move toward more flexible and adaptive approaches that had better reflect the complexity of the real world and our limitations in fully understanding it.

Definition 1 ([13-15]) : The *neutrosophic set N* It is characterized by three membership functions, which are the truth membership function T_A, the indeterminacy membership functionI_A and membership function to falsehood F_A, where $U$is the Universe of Discourse and $\forall x \in U$, $T_A(x), I_A(x), F_A(x) \subseteq]^-_t0, 1^+[$, and $^-_t0 \leq \inf T_A(x) + \inf I_A(x) + \inf F_A(x) \leq \sup T_A(x) + \sup I_A(x) + \sup F_A(x) \leq 3^+$.

See that, according to the definition, $T_A(x), I_A(x)$ and $F_A(x)$ are standard or non-standard real subsets of $]^-_t0, 1^+[$and, therefore, $T_A(x), I_A(x)$and $F_A(x)$can be subintervals of $[0, 1]$. $^-_t0$and1^+ They belong to the set of hyperreal numbers.

Definition 2 ([13-15] : The *single- valued neutrosophic set (* SVN S) $A$is U, $T_A: U \to [0,1]$where $A = \{< x, T_A(x), I_A(x), F_A(x) > : x \in U\}$and $I_A: U \to [0,1]$. $F_A: U \to [0,1]$.$0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$

The single-valued neutrosophic number (SVN N) is symbolized by

$N = (t, i, f)$, such that$0 \leq t, i, f \leq 1$ and $0 \leq t + i + f \leq 3$.

Definition 3 ([13-15]) : The *single -valued triangular neutrosophic number* , $\tilde{a} = \langle (a_1, a_2. a_3); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle$, is a neutrosophic set in $\mathbb{R}$, whose membership functions of truth, indeterminacy and falsity are defined as follows:

$$T_{\tilde{a}}(x) = \begin{cases} \alpha_{\tilde{a}\left(\frac{x-a_1}{a_2-a_1}\right), a_1 \leq x \leq a_2} \\ \alpha_{\tilde{a}, x=a_2} \\ \alpha_{\tilde{a}\left(\frac{a_3-x}{a_3-a_2}\right), a_2 < x \leq a_3} \\ 0, \text{otherwise} \end{cases} \quad (1)$$

$$I_{\tilde{a}}(x) = \begin{cases} \frac{(a_2 - x + \beta_{\tilde{a}}(x-a_1))}{a_2-a_1}, a_1 \leq x \leq a_2 \\ \beta_{\tilde{a},}\ x = a_2 \\ \frac{(x - a_2 + \beta_{\tilde{a}}(a_3-x))}{a_3-a_2},\ a_2 < x \leq a_3 \\ 1, \text{otherwise} \end{cases} \quad (2)$$

$$F_{\tilde{a}}(x) = \begin{cases} \frac{(a_2 - x + \gamma_{\tilde{a}}(x-a_1))}{a_2-a_1}, a_1 \leq x \leq a_2 \\ \gamma_{\tilde{a},} x = a_2 \\ \frac{(x - a_2 + \gamma_{\tilde{a}}(a_3-x))}{a_3-a_2},\ a_2 < x \leq a_3 \\ 1, \text{otherwise} \end{cases} \quad (3)$$

Where $\alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \in [0, 1]$,$a_1$, $a_2, a_3 \in \mathbb{R}$ and $a_1 \leq a_2 \leq a_3$.

Definition 4 ([13-15]): Given$\tilde{a} = \langle (a_1, a_2, a_3); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle$ and $\tilde{b} = \langle (b_1, b_2, b_3); \alpha_{\tilde{b}}, \beta_{\tilde{b}}, \gamma_{\tilde{b}} \rangle$ two triangular neutrosophic numbers of a single value andλ any non-zero number on the real line. Then, the following operations are defined:

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

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

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

4. Multiplication by a scalar number:

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$$\lambda\tilde{a} = \begin{cases} \langle(\lambda a_1, \lambda a_2, \lambda a_3); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}}\rangle, \lambda > 0 \\ \langle(\lambda a_3, \lambda a_2, \lambda a_1); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}}\rangle, \lambda < 0 \end{cases}$$

5. Division of two triangular neutrosophic numbers:

$$\frac{\tilde{a}}{\tilde{b}} = \begin{cases} \langle\left(\frac{a_1}{b_3}, \frac{a_2}{b_2}, \frac{a_3}{b_1}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle, a_3 > 0 \text{ and } b_3 > 0 \\ \langle\left(\frac{a_3}{b_3}, \frac{a_2}{b_2}, \frac{a_1}{b_1}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle, a_3 < 0 \text{ and } b_3 > 0 \\ \langle\left(\frac{a_3}{b_1}, \frac{a_2}{b_2}, \frac{a_1}{b_3}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle, a_3 < 0 \text{ and } b_3 < 0 \end{cases}$$

6. Multiplication of two triangular neutrosophic numbers:

$$\tilde{a}\tilde{b} = \begin{cases} \langle(a_1b_1, a_2b_2, a_3b_3); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle, \ a_3 > 0 \text{ and } b_3 > 0 \\ \langle(a_1b_3, a_2b_2, a_3b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle, a_3 < 0 \text{ and } b_3 > 0 \\ \langle(a_3b_3, a_2b_2, a_1b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle, a_3 < 0 \text{ and } b_3 < 0 \end{cases}$$

Where,$\wedge$ it is a norm$\vee$ it is a t-conorm.

The AHP technique begins with the designation of a hierarchical structure, where the upper elements of the tree are more generic than those corresponding to the lower levels do. The main sheet is unique and denotes the objective to be achieved in decision-making.

The level immediately below contains the sheets that represent the criteria. Immediately at the level below this, the sheets corresponding to the sub criteria appear, and so on. The level at the bottom represents the alternatives

Subsequently, a square matrix is formed that represents the opinion of the expert or experts that contains the pairwise comparison of the evaluations of the criteria, sub criteria and alternatives. TL Saaty, the founder of the original method, proposed a linguistic scale that appears in Table 1.

Table 1: Intensity of importance according to the classic AHP. Source [16-19].

Intensity of importance on an absolute scale	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective.
3	Moderate importance of one over the other	Experience and judgment strongly favor one activity over another.
5	Essential or strong importance	Experience and judgment strongly favor one activity over another.
7	very strong importance	The activity is strongly favored and its mastery is demonstrated in practice
9	Extremely important	The evidence favoring one activity over another is of the highest order of affirmation possible.
2, 4, 6, 8	Intermediate values between the two adjacent judgments.	When understanding is needed
Reciprocals	If activity *i* has one of the above numbers assigned compared to activity *j* , then *j* has the reciprocal value compared to *i* .	

On the other hand, Saaty established that the *Consistency Index* (CI) must depend on λ_{max} , the maximum eigenvalue of the matrix. He defined the equation $CI = \frac{\lambda_{max} - n}{n-1}$, where n is the order of the matrix. Furthermore, he defined the *Consistency Ratio* (CR) with the equation CR = CI/RI, where RI is given in Table 2.

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Table 2: RIs associated with each order.

Order (n)	1	2	3	4	5	6	7	8	9	10
Rhode Island	0	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49

If CR≤10%we can consider the experts' evaluation to be consistent, enough and therefore we can proceed to use AHP.

The objective of the AHP is to establish a ranking between the criteria, sub-criteria and alternatives according to a score. It can also be used in-group decision problems. If this is the purpose, Equations 4 and 5 must be taken into account, where the weight of the expert is evaluated, based on his authority, knowledge, experience, etc.

$$\bar{x} = \left(\prod_{i=1}^{n} x_i^{w_i}\right)^{1/\sum_{i=1}^{n} w_i} \quad (4)$$

If $\sum_{i=1}^{n} w_i = 1$, that is, when the expert's weights add up to one, Equation 4 is transformed into Equation 5,

$$\bar{x} = \prod_{i=1}^{n} x_i^{w_i} \quad (5)$$

Hybridization of AHP with neutrosophic set theory was used in [16, 17, 18]. This is a more flexible approach to modeling uncertainty in decision-making. Indeterminacy is an essential component that must be assumed in real-world organizational decisions. Table 3 contains the adaptation of the Saaty scale to the neutrosophic field.

Table 3: The Saaty scale was translated into a neutrosophic triangular scale. Source [16].

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

The pairwise neutrosophic comparison matrix is defined in Equation 6.

$$\tilde{A} = \begin{bmatrix} \tilde{1} & \tilde{a}_{12} & \cdots & \tilde{a}_{1n} \\ \vdots & & \ddots & \vdots \\ \tilde{a}_{n1} & \tilde{a}_{n2} & \cdots & \tilde{1} \end{bmatrix} \quad (6)$$

$\tilde{A}$ satisfies the condition $\tilde{a}_{ji} = \tilde{a}_{ij}^{-1}$, according to the inversion operator defined in Definition 4 .

In [20] indices are defined to convert a neutrosophic triangular number into a sharp number. See Equation 7 for *scoring* and Equation 8 for *accuracy*.

$$S(\tilde{a}) = \frac{1}{8}[a_1 + a_2 + a_3](2 + \alpha_{\tilde{a}} - \beta_{\tilde{a}} - \gamma_{\tilde{a}}) \quad (7)$$

$$A(\tilde{a}) = \frac{1}{8}[a_1 + a_2 + a_3](2 + \alpha_{\tilde{a}} - \beta_{\tilde{a}} + \gamma_{\tilde{a}}) \quad (8)$$

The algorithm to apply The NAHP is the following:

Given the Criteria, subcriteria and alternatives, the NAHP consists of the following steps:

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1. Design an AHP tree. Contains the selected criteria, sub criteria and alternatives.

2. Create the matrices by level from the AHP tree, according to expert criteria expressed in neutrosophic triangular scales and respecting the matrix scheme of Equation 6.

3. To evaluate the consistency of these arrays, convert the elements of $\tilde{A}$ into a crisp matrix by applying Equation 7 or 8 and then testing the consistency of this new crisp matrix.

4. Follow the other steps of a classic AHP.

5. Equation 7 or 8 is applied to convert, $w_1, w_2, \ldots, w_n$ to crunchy weights.

6. If more than one expert performs the evaluation, then $w_1, w_2, \ldots, w_n$ are replaced by $\overline{w}_1, \overline{w}_2, \cdots, \overline{w}_n$, which are their corresponding weighted geometric mean values, see Equations 4 and 5 .

3. Results and Discussion

Cyberviolence and gender violence among students and young people can be influenced by various interrelated factors:

FACT 1: Anonymity and Online Disinhibition. The ability to remain anonymous on digital platforms can lead to more aggressive and demeaning behaviors that would not be expressed in face-to-face interactions.

FACT 2: Normalization of Abusive Behaviors. Constant exposure to media and social content that trivializes or glorifies violence can desensitize young people, normalizing abusive behavior.

FACT 3: Perpetuation of Gender Stereotypes. Social media and other digital media can reinforce stereotypical gender roles, which often underlie violent attitudes and behaviors toward people of specific genders.

FACT 4: Lack of Digital Education and Critical Awareness. The absence of educational programs that teach young people about the ethical and responsible use of technology may contribute to ignorance about the consequences of their online actions.

FACT 5: Inequality of Power and Control. Unequal power dynamics in interpersonal relationships can be amplified in digital environments, where control and coercion can be exercised in more subtle but equally damaging ways.

FACT 6: Uncontrolled Access to Inappropriate Content. Ease of access to inappropriate content online, such as violent pornography, can distort perceptions of healthy relationships and contribute to abusive behaviors.

FACT 7: Lack of Protection and Clear Policies. The absence of effective policies on digital platforms to prevent and address cyber and gender-based violence leaves young people vulnerable and limits appropriate protection and support options.

Then, each of the 4 specialists compare these 7 factors according to the scale shown in Table 3. Each specialist is assigned the same weight or importance of his or her opinion equal to$w_i = \frac{1}{4}$

The next steps are:

1. Each specialist evaluates the 7 factors according to their neutrosophic knowledge.

2. These neutrosophic matrices were converted to sharp matrices with Equation 8.

3. The CR of each of these matrices were determined.

If all experts gathered an appropriate CR, proceed to step 4.

Those WHOs that do not comply, as always, must repeat the evaluation.

4. The weights assigned to each of the 7 factors by each expert are added with the help of Equation 8. These will be the final weights sought.

Tables 4-7 contain the result of the neutrosophic pair in comparison with the matrix for experts 1, 2, 3 and 4, respectively.

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Table 4: Pairwise neutrosophic comparison matrix obtained from expert 1.

Variable	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6	FACT7
FACT1	1/2	1/2	1/3	1/3	1/3	1/3	1/2
FACT2	1/3	1/2	2	1/2	1/2	1	1/2
FACT3	2	1	1/3	1	1/3	1	1
FACT4	1/3	1	1/2	2	1	1	1
FACT5	1	1/3	1	1	1/2	2	1/3
FACT6	2	1/2	2	1	1	1	1/2
FACT7	2	1	1	1	2	2	1

Table 5: Pairwise neutrosophic comparison matrix obtained from expert 2.

Variable	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6	FACT7
FACT1	1/3	1/3	1/2	1/2	1/2	1/3	1/3
FACT 2	1/2	1	1/2	1/3	1/2	2	1/2
FACT3	1/3	1	1	2	1	1/3	1/3
FACT4	1	1	1	1/3	1	1/2	1
FACT5	1/2	2	1/3	1	1/3	1	1/2
FACT6	1	1	1/2	2	1/2	2	1
FACT7	2	2	1	2	1	1	2

Table 6: Pairwise neutrosophic comparison matrix obtained from expert 3.

Variable	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6	FACT7
FACT1	1/3	1/2	1/3	1/2	1/2	1/2	1/2
FACT2	2	1/3	2	1/2	1/3	1/2	1/3
FACT3	1/3	2	1/3	1	2	1	2
FACT4	1/2	1/3	1/2	1	1/3	1	1/3
FACT5	1	1	1	1/3	1	1/3	1
FACT6	2	2	2	1/2	2	1/2	2
FACT7	1	2	1	1	2	1	2

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Table 7: Pairwise neutrosophic comparison matrix obtained from expert 4.

Variable	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6	FACT7
FACT1	1/2	1/2	1/3	1/3	1/3	1/3	1/2
FACT2	1/3	1/2	2	1/2	1/2	1	1/2
FACT3	2	1	1/3	1	1/3	1	1
FACT4	1/3	1	1/2	2	1	1	1
FACT5	1	1/3	1	1	1/2	2	1/3
FACT6	2	1/2	2	1	1	1	1/2
FACT7	2	1	1	1	2	2	1

The calculation of the CRs resulted in CR = 8.5731% for Expert 1, CR = 3.9017% for Expert 2, CR = 4.8985% for Expert 3 and CR = 6.5842% for Expert 4. So, always $CR \leq 10\%$.

The weights associated with each of the variables are shown in Table 8.

Table 8: Weights obtained for each of the variables by the experts.

Expert/Variable	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6	FACT7
1	0.17807	0.37807	0.32252	0.32252	0.11473	0.33204	0.33204
2	0.225837	0.342053	0.082832	0.342053	0.354348	0.326453	0.326453
3	0.203632	0.383524	0.078080	0.078080	0.383524	0.157636	0.383524
4	0.362387	0.362387	0.362387	0.362387	0.362387	0.074533	0.074533

To obtain the vector of weights of each variable according to each expert, we must calculate the average of the weights assigned by each expert to each variable. Here are the detailed calculations for each variable (FACT1 to FACT7) according to the four experts:

FACT1:

Expert 1: 0.17807

Expert 2: 0.225837

Expert 3: 0.203632

Expert 4: 0.362387

Average weights for FACT1:

Mean FACT1=0.17807+0.225837+0.203632+0.3623874=0.2429815

FACT2:

Expert 1: 0.37807

Expert 2: 0.342053

Expert 3: 0.383524

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Expert 4: 0.362387

Average weights for FACT2:

Mean FACT2=0.37807+0.342053+0.383524+0.3623874=0.3662585

FACT3:

Expert 1: 0.32252

Expert 2: 0.082832

Expert 3: 0.07808

Expert 4: 0.362387

Average weights for FACT3:

Mean FACT3=0.32252+0.082832+0.07808+0.3623874=0.21195475

FACT4:

Expert 1: 0.32252

Expert 2: 0.342053

Expert 3: 0.07808

Expert 4: 0.362387

Average weights for FACT4:

Mean FACT4=0.32252+0.342053+0.07808+0.3623874=0. 27601

FACT5:

Expert 1: 0.11473

Expert 2: 0.354348

Expert 3: 0.383524

Expert 4: 0.362387

Average weights for FACT5:

Mean FACT5=0.11473+0.354348+0.383524+0.3623874=0.30374725

FACT6:

Expert 1: 0.33204

Expert 2: 0.326453

Expert 3: 0.157636

Expert 4: 0.074533

Average weights for FACT6:

Mean FACT6=0.33204+0.326453+0.157636+0.0745334=0.2224155

FACT7:

Expert 1: 0.33204

Expert 2: 0.326453

Expert 3: 0.383524

Expert 4: 0.074533

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Average weights for FACT7:

Mean FACT7=0.33204+0.326453+0.383524+0.0745334=0.2798875

Therefore, the weight vectors for variable FACTda, according to the average of the evaluations of the four experts, are the following:

FACT1: (0.2429815, 0.3662585, 0.21195475, 0.27601)

FACT2: (0.2429815, 0.3662585, 0.21195475, 0.27601)

FACT3: (0.2429815, 0.3662585, 0.21195475, 0.27601)

FACT4: (0.2429815, 0.3662585, 0.21195475, 0.27601)

FACT5: (0.2429815, 0.3662585, 0.21195475, 0.27601)

FACT6: (0.2429815, 0.3662585, 0.21195475, 0.27601)

FACT7: (0.2429815, 0.3662585, 0.21195475, 0.27601)

These vectors represent the relative weights of each variable according to the average opinion of the four expert evaluators.

Factors	Pesos
FACT1	0.2429815
FACT2	0.3662585
FACT3	0.21195475
FACT4	0.27601
FACT5	0.30374725
FACT6	0.2224155
FACT7	0.2798875

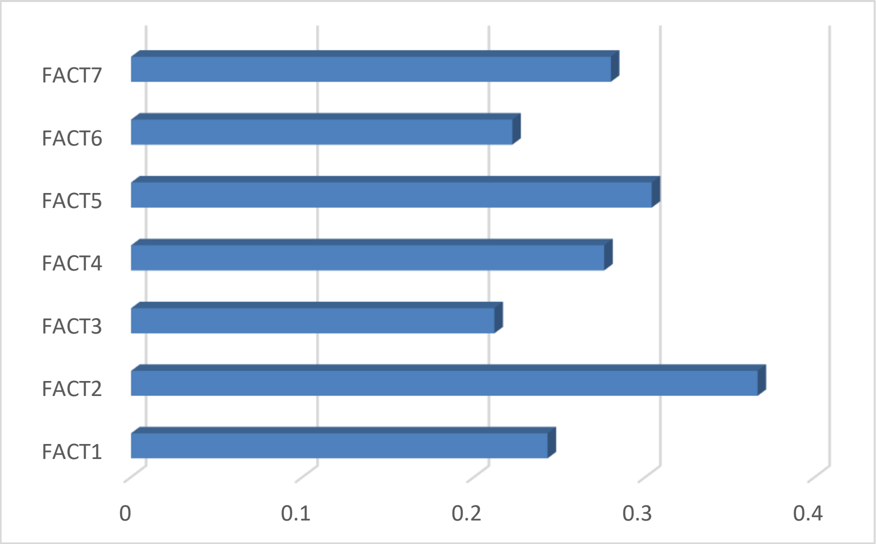

Figure 1. Weights obtained for each of the variables.

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Most influential and determining factors that contribute to cyberviolence and gender violence among students and young people:

FACTORS	PESOS
Normalization of Abusive Behaviors. Constant exposure to media and social content that trivializes or glorifies violence can desensitize young people, normalizing abusive behavior.	0.3662585
Inequality of Power and Control. Unequal power dynamics in interpersonal relationships can be amplified in digital environments, where control and coercion can be exercised in more subtle but equally damaging ways.	0.30374725
Lack of Protection and Clear Policies. The absence of effective policies on digital platforms to prevent and address cyber and gender-based violence leaves young people vulnerable and limits appropriate protection and support options.	0.2798875

Cyber violence and gender violence among students and young people are complex and multifaceted phenomena, influenced by various factors that affect their perpetuation and severity. Among the most influential are the normalization of abusive behavior, the inequality of power and control in interpersonal relationships, and the lack of protection and clear policies in digital environments. The normalization of abusive behavior plays a crucial role in desensitizing young people to violence, both physical and emotional, which is trivialized or glorified through the media and social networks. This constant exposure can distort perceptions about what constitutes a healthy and safe relationship, perpetuating cycles of violence and victimization. On the other hand, unequal power dynamics within interpersonal relationships are intensified in digital environments, where control and coercion can be exercised in more subtle but equally damaging ways. This translates into relationships marked by manipulation and emotional abuse, exacerbating the vulnerability of young people to situations of violence. Furthermore, the lack of protection and clear policies on digital platforms represents a serious obstacle to the prevention and addressing of cyberviolence and gender violence. The absence of effective regulatory frameworks leaves young people exposed to risks without the necessary tools to protect themselves or receive adequate support. This not only limits options for intervention, but also perpetuates an environment where impunity can prevail. Assessing these factors implies recognizing the urgency of implementing comprehensive strategies that address both the causes and consequences of these social problems. The normalization of abusive behavior demands media education that promotes criticism and reflection on the content consumed online, promoting respectful and equitable models of behavior from an early age.

Regarding power dynamics, it is essential to promote relationships based on mutual respect and equality, promoting the empowerment of young people to recognize and resist situations of manipulation or coercion. This requires not only educational policies, but also awareness-raising strategies that strengthen the self-defense capacity of individuals. Finally, improving protection in digital environments involves developing and applying clear policies that regulate online behavior, ensuring that technological platforms are safe and responsible spaces for all users, especially those most vulnerable to gender violence and cyber violence. Effectively addressing cyber and gender-based violence among students and youth requires a comprehensive approach that combines education, awareness-raising and effective regulation. Only in this way can we build digital and social environments where everyone can develop freely, without fear of violence or discrimination.

4. Conclusión

Cyber violence and gender violence among students and young people are complex and multifaceted phenomena, influenced by various factors that affect their perpetuation and severity. Among the most influential are the normalization of abusive behavior, the inequality of power and control in interpersonal relationships, and the lack of protection and clear policies in digital environments. The normalization of abusive behavior plays a crucial role in desensitizing young people to violence, both physical and emotional, which is trivialized or

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Assessing these factors implies recognizing the urgency of implementing comprehensive strategies that address both the causes and consequences of these social problems. The normalization of abusive behavior demands media education that promotes criticism and reflection on the content consumed online, promoting respectful and equitable models of behavior from an early age. Regarding power dynamics, it is essential to promote relationships based on mutual respect and equality, promoting the empowerment of young people to recognize and resist situations of manipulation or coercion. This requires not only educational policies, but also awareness-raising strategies that strengthen the self-defense capacity of individuals. Finally, improving protection in digital environments involves developing and applying clear policies that regulate online behavior, ensuring that technological platforms are safe and responsible spaces for all users, especially those most vulnerable to gender violence and cyber violence. Effectively addressing cyber and gender-based violence among students and youth requires a comprehensive approach that combines education, awareness-raising and effective regulation. Only in this way can we build digital and social environments where everyone can develop freely, without fear of violence or discrimination.

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