NSS
Neutrosophic Sets and Systems, Vol. 88, 2025
University of New Mexico

Model for the Evaluation of the EDUCOM-DIGITAL Project Effectiveness at the Santa Elena Peninsula State University Based on Plithogenic OffSet

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Abstract. EDUCOM-DIGITAL is an educational project of the Santa Elena Peninsula State University (SEPSU) aimed at overcoming challenges related to digital educational communication at this university in this Ecuadorian province. Technological, economic, and cognitive barriers, among others, hinder the adequate development of digital educational communication in our province. From a theoretical perspective, the project contributes to generating new knowledge by developing an innovative model for integrating podcasts into teaching and scientific outreach. The uniqueness of this proposal lies in its application in vulnerable educational contexts, which will allow for the exploration of pedagogical strategies tailored to the needs of teachers and students with limited resources. Addressing this issue expands the conceptual framework of digital educational communication and provides empirical evidence of its impact on university education. In practical terms, the project will allow for the validation of existing theories on the effectiveness of digital formats in autonomous learning and scientific communication. Several studies have indicated that podcasts can improve content comprehension, facilitate access to academic information, and encourage critical reflection in students. However, their implementation at the SEPSU will allow these postulates to be tested in a real-life context, evaluating how the use of audio resources influences the acquisition of knowledge and the development of communication skills in the university community. This paper aims to propose an evaluative model for the effectiveness of this project, but this implies overcoming two challenges, which are: (1) The presence of several variables of different origins that are based on subjective perceptions and therefore present uncertainty and indeterminacy; (2) The need for a measurement scale that is sufficiently expressive of the different possible evaluations to be carried out. Therefore, we propose to base this model on the Plithogenic OffSets, which is a MultiVariate and Multidimensional theory such that the evaluations of the propositions are based on intervals with values less than 0 or greater than 1. Therefore, situations of loss or over-fulfillment can be modeled.

Keywords: Higher Education**;** Digital Educommunication; Plithogeny; Plithogenic Set; OffSet/OverSet/UnderSet; Plithogenic OffSet/OverSet/UnderSet.

1. Introduction

Higher education in the province of Santa Elena, specifically at the Santa Elena Peninsula State University (SEPSU), faces significant challenges in integrating innovative digital tools into teaching-learning and scientific outreach processes. Despite technological advancements, gaps in digital and communication skills persist, limiting inclusion and educational resilience within the university community. However, faculties in the SEPSU have demonstrated a growing interest and commitment to incorporating the latest research advances into their teaching practices, motivated by the desire to significantly improve their students' learning.

In Ecuador, some experiences and researches have been presented. However, educommunication hasn't been fully institutionalized in the education system yet. Specifically, one of the main gaps in knowledge relates to the weak implementation of digital educommunication strategies. Although digital technologies have transformed education, SEPSU lacks structured strategies that incorporate innovative formats such as educational podcasts. This limits access to knowledge and diminishes student motivation, negatively impacting the learning experience.

Another identified problem is the limited dissemination of scientific research within universities. Many of the studies conducted by faculty and students do not reach a broad audience due to the lack of accessible channels and attractive formats for their dissemination. This situation reduces the social and academic impact of the knowledge generated in the institution, affecting its visibility and relevance in the scientific and educational community. In Ecuador, there is a need to debate the relationship between research and academic offerings at universities.

Furthermore, there are contradictory results in the literature regarding the effectiveness of podcasts in higher education. While international studies describe podcasts as a novel educational tool with a significant impact on independent learning, in the context of Santa Elena, barriers such as irregular connectivity, limited access to digital devices, and lack of training in podcast production are identified. This is confirmed in the studies, which found that 37% of students consider the internet quality at their university to be poor, concluding that the telecommunications infrastructure at these institutions is deficient. These contradictions justify the need for research analyzing the real impact of podcasts in this specific environment.

Another critical aspect is the lack of technical and communication skills in the university community. Many faculty and students lack training in the creation and use of podcasts as an educational and scientific dissemination resource. This deficit hinders the implementation of effective digital educational communication strategies, limiting the possibility of transforming teaching and learning through these media. Therefore, faculty training in tools such as podcasts is necessary, as they streamline learning processes and promote educational innovation.

To address all these problems, a project called EDUCOM-DIGITAL is proposed. It is based on a theoretical, practical, and social rationale that positions it as a relevant proposal in the field of digital education and communication in higher education. In a context where information and communication technologies play a crucial role in teaching and the dissemination of knowledge, this initiative seeks to harness the potential of educational podcasts as accessible and innovative learning tools. Its implementation at the Santa Elena Peninsula State University (SEPSU), an educational environment with technological and infrastructure limitations, highlights its relevance for bridging digital divides and strengthening communication skills.

As with any project that is intended to be implemented, its effectiveness must be determined. Therefore, in this paper, we propose a model for measuring the effectiveness of EDUCOM-DIGITAL. Due to the novelty of the project itself and its novelty in the Ecuadorian university context, any assessment is uncertain and indeterminate. Furthermore, variables of different types and origins must be measured, with complex dynamic interactions between them. For this reason, we selected the theory of Plithogeny, introduced by F. Smarandache to model situations that consider the dynamic interaction between concepts, their opposites, and neutrals [1, 2].

Additionally, F. Smarandache introduced OffSets, OverSets, and UnderSets, which are sets with truth value evaluations outside the range [0, 1] ([3]). This allows modeling situations where greater expressiveness and case differentiation can be added, such as evaluating the case of a student who completes all assigned tasks in an excellent manner, which would be evaluated with a truth value of 1; however, it could be differentiated from another student who also completes more unassigned tasks in an excellent manner, where a truth value greater than 1 would have to be used. On the other hand, if a student does not complete the assigned tasks and also performs actions that cause losses for his/her institution, then the most appropriate action would be to evaluate him/her with a negative truth value [4]. Some applications of this theory can be read in [5, 6].

Hybridization between Plithogenic sets with OffSets/OverSets/UnderSets results in Plithogenic OffSets/OverSets/UnderSets [7]. Thus, situations where there are multiple variables are modeled and at the same time a more expressive scale is used that goes outside the framework of the classic interval [0, 1]. To take advantage of the benefits that exist with this hybridization, we propose to model the effectiveness of EDUCOM-DIGITAL using the Plithogenic OffSets.

This paper is divided into a Related Work section, where the concepts of Plithogenic Set, OffSet/OverSet/UnderSet, and Plithogenic OffSet/OverSet/UnderSet are explained. The Proposed Model section contains the elements of the proposed model, with an illustrative example. The final section is the Conclusion.

2. Related Work

This section reminds the main concepts about the Plithogenic Set, Offset, Overset, Underset, and Plithogenic OffSet/OverSet/UnderSet.

A. Plithogenic set

Definition 1 ([1, 7]). Let U be a universal set. A *Plithogenic Set* PS, where P is a subset of S is defined as:

$\mathrm{PS} = (\mathrm{P}, \mathrm{v}, \mathrm{Pv}, \mathrm{pdf}, \mathrm{pcf})$, such that:

- v is an attribute,
- Pv is the range of possible values for v,
- pdf: $\mathrm{P} \times \mathrm{Pv} \to [0,1]^s$ is the *Degree of Appurtenance Function* (*DAF*),
- pcf: $\mathrm{Pv} \times \mathrm{Pv} \to [0,1]^t$ is the *Degree of Contradiction Function* (*DCF*).

Then, for all $a, b \in \mathrm{Pv}$, pcf satisfies:

1. $\mathrm{pcf}(a,a) = 0$, reflexivity of the DCF.
2. $\mathrm{pcf}(a,b) = \mathrm{pcf}(b,a)$, commutativity of the DCF.

They are classified as follows:

- For s = t = 1, it is a *Plithogenic Fuzzy Set*;
- For s = 2, t = 1, it is a *Plithogenic Intuitionistic Fuzzy Set*;
- For s = 3, t = 1, it is a *Plithogenic Neutrosophic Set;*
- For s = 4, t = 1, it is a *Plithogenic Quadripartitioned Neutrosophic Set*;
- For s = 5, t = 1, it is a *Plithogenic Pentapartitioned Neutrosophic Set*;
- For s = 6, t = 1, it is a *Plithogenic Hexapartitioned Neutrosophic Set*;
- For s = 7, t = 1, it is a *Plithogenic Heptapartitioned Neutrosophic Set*;
- For s = 8, t = 1, it is a *Plithogenic Octopartitioned Neutrosophic Set*;
- For s = 9, t = 1, it is a *Plithogenic Nonapartitioned Neutrosophic Set*.

More about this theory and application can be read in [8-16].

B. Plithogenic Offset/Overset/Underset

Definition 2 ([7]). Let X be a universe of discourse. Additionally, Ψ represents true and Ω represents false. $A \subseteq X$ is a *Crisp Offset* if there is a characteristic function $\chi_A : X \to \{\Psi, \Omega\}$ such that:

$$\chi_A(x) = \begin{cases} \Omega, \text{if x} \in \text{A}, \\ \Psi, \text{if x} \notin \text{A}. \end{cases}$$

Definition 3 ([7]). Let X be a universe of discourse. $\tilde{A}$ is a subset of X and it is called a *Fuzzy Offset* if it is defined as follows:

$\tilde{A} = \{(x, \mu_{\tilde{A}}(x)) : x \in X, \mu_{\tilde{A}}(x) \in [\Psi, \Omega]\}$, where $\Psi < 0$ and $\Omega > 1$.

Definition 4 ([7]). Let X be a universe of discourse. A_{off} is a subset of X and it is called a *Single-Valued Neutrosophic Offset* if it is defined as follows:

$A_{off} = \{(x, \langle T(x), I(x), F(x)\rangle) : x \in X,\ s.t.\ \exists (T(x), I(x), F(x) < 0 \text{ or } T(x), I(x), F(x) > 1)\}$, so:

- $T(x)$ is the truth-membership function, $I(x)$ is the indeterminacy-membership function, and $F(x)$ is the falsity-membership function.
- $T(x), I(x), F(x) \in [\Psi, \Omega]$, where $\Psi < 0$ (called *UnderLimit*) and $\Omega > 1$ (called *OverLimit*).
- When the interval is $[\Psi, 1]$ and $\Psi < 0$, then it is an *UnderSet*.
- When the interval is $[0, \Omega]$ and $\Omega > 1$, then it is an *OverSet*.

Definition 5 ([7]). Let X be a universal set. A *Plithogenic Offset* PS_{off}, where P is a subset of S is defined as:

$\mathrm{PS}_{Off} = (\mathrm{P}, \mathrm{v}, \mathrm{Pv}, \mathrm{pdf}, \mathrm{pcf})$, such that:

- v is an attribute,

- Pv is the range of possible values for v,
- pdf: P × Pv → $[\Psi_v, \Omega_v]^s$ is the *Degree of Appurtenance Function* (*DAF*),
- pcf: Pv × Pv → $[\Psi_v, \Omega_v]^t$ is the *Degree of Contradiction Function* (*DCF*).

Where $\Psi_v < 0$ and $\Omega_v > 1$.

- When the interval is $[\Psi_v, 1]$ and $\Psi_v < 0$, then it is a *Plithogenic UnderSet*.
- When the interval is $[0, \Omega_v]$ and $\Omega_v > 1$, then it is a *Plithogenic OverSet*.

Equivalently to the Plithogenic Sets, we have the following classifications:

- For s = t = 1, it is a *Plithogenic Fuzzy OffSet*;
- For s = 2, t = 1, it is a *Plithogenic Intuitionistic Fuzzy OffSet*;
- For s = 3, t = 1, it is a *Plithogenic Neutrosophic OffSet*;
- For s = 4, t = 1, it is a *Plithogenic Quadripartitioned Neutrosophic OffSet*;
- For s = 5, t = 1, it is a *Plithogenic Pentapartitioned Neutrosophic OffSet*;
- For s = 6, t = 1, it is a *Plithogenic Hexapartitioned Neutrosophic OffSet*;
- For s = 7, t = 1, it is a *Plithogenic Heptapartitioned Neutrosophic OffSet*;
- For s = 8, t = 1, it is a *Plithogenic Octopartitioned Neutrosophic OffSet*;
- For s = 9, t = 1, it is a *Plithogenic Nonapartitioned Neutrosophic OffSet*.

Example 1 ([7]): Let X be the set of suspected medical conditions. Then, for each medical condition $x \in X$ we have the following neutrosophic degrees $T(x), I(x), F(x) \in [\Psi, \Omega]$, extended beyond the classical interval $[0, 1]$.

$A_{off} = \{(Disease\ X, \langle T(X) = 1.1, I(X) = 0.4, F(X) = 0.2\rangle), (Disease\ Y, \langle T(Y) = 0.7, I(X) = 0.6, F(X) = 0.1\rangle)\}$.

Then, while for Disease Y we have a standard evaluation of truthfulness, indeterminacy, and falseness, for Disease X we have the following interpretation:

- $T(X) = 1.1$: There is a high probability of suffering from disease X because of advanced diagnostic tools,
- $I(X) = 0.4$: There is a moderate uncertainty due to overlapping symptoms with other disorders,
- $F(X) = -0.2$: There is a negative falsity because atypical symptoms decrease the likelihood of misdiagnosis.

Let X be a universe of discourse, $A = \{(x, \langle T_A(x), I_A(x), F_A(x)\rangle), x \in X\}$ and $B = \{(x, \langle T_B(x), I_B(x), F_B(x)\rangle), x \in X\}$ be two single-valued neutrosophic Offsets/Oversets/Undersets/.

$T_A, I_A, F_A, T_B, I_B, F_B$: X→[Ψ, Ω], where Ψ≤ 0 < 1 ≤Ω, Ψ is the Underlimit, while Ω is the Overlimit, $T_A(x)$, $I_A(x)$, $F_A(x)$,$T_B(x)$, $I_B(x)$, $F_B(x)\in[\Psi, \Omega]$.

Then the main operators are defined as follows [5]:

$A \cup B = \{(x, \langle \max(T_A(x), T_B(x)), \min(I_A(x), I_B(x)), \min(F_A(x), F_B(x))\rangle), x \in X\}$ is the union.

$A \cap B = \{(x, \langle \min(T_A(x), T_B(x)), \max(I_A(x), I_B(x)), \max(F_A(x), F_B(x))\rangle), x \in X\}$ is the intersection,

$C(A) = \{(x, \langle F_A(x), \Psi + \Omega - I_A(x), T_A(x)\rangle), x \in X\}$ is the neutrosophic complement of the neutrosophic set.

One *OffNegation* can be defined as in Equation 1.

$$\overline{\text{off}}\langle T, I, F\rangle = \langle F, \Psi_I + \Omega_I - I, T\rangle \qquad (1)$$

Definition 6. Let *c* be a neutrosophic component (T_{Off}, I_{Off}, or F_{Off}). *c*: M_{Off}→[Ψ, Ω], where Ψ≤ 0 and Ω≥1.The *neutrosophic component N-OffNorm* N^n_{off}: $[\Psi, \Omega]^2 \to [\Psi, \Omega]$ satisfies the following conditions for any elements *x*, *y*, and *z* ∈M_{off}:

i. $N^n_{off}(c(x), \Psi) = \Psi$, $N^n_{off}(c(x), \Omega) = c(x)$ (Overbounding Conditions),
ii. $N^n_{off}(c(x), c(y)) = N^n_{off}(c(y), c(x))$(Commutativity),
iii. If $c(x) \le c(y)$ then $N^n_{off}(c(x), c(z)) \le N^n_{off}(c(y), c(z))$ (Monotonicity),

iv. $N^{n}_{off}(N^{n}_{off}(c(x), c(y)), c(z)) = N^{n}_{off}\big(c(x), N^{n}_{off}(c(y), c(z))\big)$ (Associativity).

We can use the following simplified notation $\langle T_1, I_1, F_1\rangle \overset{\wedge}{}_{off} \langle T_2, I_2, F_2\rangle = \langle T_1 \overset{\wedge}{}_{off} T_2,\ I_1 \overset{\vee}{}_{off} I_2, F_1 \overset{\vee}{}_{off} F_2\rangle$.

Definition 7. Let c be a neutrosophic component (T_{Off}, I_{Off}, or F_{Off}). c: $M_{Off} \to [\Psi, \Omega]$, where $\Psi \leq 0$ and $\Omega \geq 1$. The neutrosophic component *N-OffConorm* N^{co}_{Off}: $[\Psi, \Omega]^2 \to [\Psi, \Omega]$ satisfies the following conditions for any elements x, y, and z $\in M_{Off}$:

i. $N^{co}_{Off}(c(x), \Omega) = \Omega$, $N^{co}_{Off}(c(x), \Psi) = c(x)$ (Overbounding Conditions),
ii. $N^{co}_{Off}(c(x), c(y)) = N^{co}_{Off}(c(y), c(x))$ (Commutativity),
iii. If $c(x) \leq c(y)$ then $N^{co}_{Off}(c(x), c(z)) \leq N^{co}_{Off}(c(y), c(z))$ (Monotonicity),
iv. $N^{co}_{Off}(N^{co}_{Off}(c(x), c(y)), c(z)) = N^{co}_{Off}\big(c(x), N^{co}_{Off}(c(y), c(z))\big)$ (Associativity).

For this, we use the notation $\langle T_1, I_1, F_1\rangle \overset{\vee}{}_{Off} \langle T_2, I_2, F_2\rangle = \langle T_1 \overset{\vee}{}_{Off} T_2,\ I_1 \overset{\wedge}{}_{Off} I_2, F_1 \overset{\wedge}{}_{Off} F_2\rangle$.

3. Proposed Model

Let us denote by $E = \{e_1, e_2, \cdots, e_n\}$ the set of n experts who carry out the evaluations of the effectiveness of the EDUCOM-DIGITAL project.

On the other hand, the EDUCOM-DIGITAL project has to satisfy the following set of objectives:

Main Objective: To design educational communication strategies based on the creation of educational podcasts, narrowing the gaps in digital and communication skills, promoting inclusion, educational resilience, and the dissemination of scientific research at the Santa Elena Peninsula State University (SEPSU).

Indicator (Denoted by v_0): Number of digital books published that document the experience of using educational podcasts, including educational communication strategies, good practices, challenges overcome, and impact on teaching, learning, and scientific dissemination.

Specific Objective 1 (Denoted by v_1): To diagnose the educational communication gaps and needs of the SEPSU scientific community, identifying key areas for improvement in digital and communication skills, facilitating effective inclusion, educational resilience, and scientific dissemination.

Indicator 1.1 (Denoted by v_{11}): Number of comprehensive diagnoses on educational communication gaps and needs in the SEPSU scientific community.

Quantity: At least one comprehensive diagnosis developed based on quantitative methodologies, which includes surveys.

Quality: The diagnosis should provide a detailed map of the educational communication gaps, considering aspects related to digital skills, academic communication strategies, and the use of technologies for scientific dissemination. It should include specific recommendations for reducing them.

Timeframe: Prepared and validated in the first six months of project execution, ensuring its applicability in the design of intervention strategies.

Indicator 1.2 (Denoted by v_{12}): Number of key areas for improvement identified in digital and communication skills.

Quantity: It is expected to identify a minimum of three key areas that represent significant gaps in the SEPSU scientific community.

Quality: The identified areas must be validated through comparative analysis with national and international standards in digital and educational communication skills. A technical report will be submitted with intervention priorities.

Timeframe: Key areas will be determined within a four-month timeframe, allowing for their use in developing project-specific strategies.

Indicator 1.3 (Denoted by v_{13}): Number of teachers trained in podcast production, editing, and distribution.

Quantity: Ten teachers will be trained in theoretical and practical workshops on the production, editing, and distribution of educational podcasts.

Quality: The training will include an applied approach, with practical sessions where participants design and produce their podcast episodes. Satisfaction and learning levels will be measured through surveys and performance tests.

Timeframe: Training sessions will be delivered in progressive modules, with follow-up sessions to ensure effective implementation of the acquired knowledge.

Specific Objective 2 (denoted by v_2). To develop innovative and accessible digital content, enhancing its alignment with SEPSU's strategic needs and strengthening interactive learning, educational inclusion, and the dissemination of scientific research.

Indicator 2.1 (Denoted by v_{21}): Number of podcasts produced and validated with feedback from research projects.

Quantity: A minimum of five educative podcasts are expected to be produced, aligned with SEPSU's strategic lines, and linked to funded research projects with results ready for publication.

Quality: Each podcast must meet professional production standards, including content based on scientific evidence, clear structure, accessibility for people with disabilities (transcription and subtitling), and validation by experts and the target audience. Validation will be done through perception surveys and engagement metrics.

Timeframe: Podcast production and validation will take place over 12 months, with progressive deliveries every quarter to ensure a steady stream of content and improve quality based on feedback.

Specific Objective 3 (Denoted by v_3). To apply educational podcasts in the SEPSU community, disseminating them externally for the development of digital and communication skills, promoting inclusion, educational resilience, and the dissemination of scientific knowledge in these environments.

Indicator: 3.1 (Denoted by v_{31}): Number of subjects that integrate podcasts in their syllabi as a teaching resource for accessing content based on research projects generated by the university.

Quantity: At least 5 subjects from different majors are expected to incorporate educational podcasts as part of their academic planning.

Quality: The integration of podcasts into syllabi must be validated by academic coordinators, to ensure their relevance to the curriculum. Follow-up will be conducted with teachers and students to assess their impact on learning.

Timeframe: The inclusion of podcasts in courses will take place over two academic semesters, allowing for adjustments and improvements based on user feedback.

Indicator 3.2 (Denoted by v_{32}): Number of digital platforms used for the dissemination of podcasts and recorded reproductions, demonstrating their reach among external audiences.

Quantity: A minimum of two digital platforms for the podcast distribution, including Spotify and one SEPSU institutional platform. A minimum of 5,000 total plays will be recorded during the implementation period.

Quality: Dissemination must ensure inclusive access by making transcripts and subtitles available on key platforms. In addition, engagement metrics (views, comments, shares) will be analyzed to assess the level of reach and impact.

Podcasts will be published and promoted on digital platforms continuously for 12 months, with quarterly metrics to analyze their growth and reach.

Objective 4 (Denoted by v_4). To evaluate the impact of podcasts on teaching, learning, and scientific dissemination, identifying their contribution to improving digital and communication skills in the educational community.

Indicator 4.1 (Denoted by v_{41}): Percentage of teachers and students from the 2026 –1 period who report improvements in their digital and communication skills after the implementation of educational podcasts.

Quantity: At least 60% of teachers and students participating in the use of educational podcasts are expected to report improvements in their digital and communication skills.

Quality: Impact assessment will be conducted using standardized instruments, such as surveys, interviews, and performance tests that measure the level of improvement in the use of digital tools and academic communication strategies.

Timeframe: Impact measurement will be conducted at the end of the second half of 2026, with a comparative analysis before and after the implementation of the podcasts to determine their effectiveness in developing skills.

Specific Objective 5 (Denoted by v_5). To systematize the experience of using educational podcasts in a report that documents the educational communication strategies implemented, best practices, challenges overcome, and their impact on teaching, learning, and scientific dissemination, strengthening soft skills and educational resilience in the university community.

Indicator 5.1 (Denoted by v_{51}): Number of manuscripts prepared that document the experience of using educational podcasts, including educational communication strategies, good practices, challenges overcome, and impact on teaching, learning, and scientific dissemination.

Quantity: The preparation of at least one manuscript is expected to systematize the experience of using educational podcasts at SEPSU.

Quality: The manuscript must meet academic and methodological rigor criteria, including qualitative and quantitative analyses of the implementation of podcasts. They should be structured with sections that address educational communication strategies, best practices, challenges overcome, and evidence of the impact on teaching, learning, and scientific dissemination.

Timeframe: The manuscript will be prepared in six months after the podcast implementation is completed, ensuring a detailed systematization of the experience and allowing for its dissemination at academic events or scientific publications.

Indicator (Denoted by v_{52}): Number of scientific papers accepted in journals of global impact.

Quantity: Acceptance and publication of at least two scientific articles in high-impact indexed journals (Scopus Q1-Q3 or WoS) is expected.

Quality: Articles must meet criteria of academic and methodological rigor, addressing the impact of using educational podcasts on teaching, learning, and scientific dissemination. They must present a solid theoretical framework, clear methodology, analysis of results, and conclusions based on empirical evidence.

Timeframe: Articles are expected to be drafted, submitted, and accepted within 12 to 18 months, taking into account peer review and editorial adjustments.

Figure 1 visually summarizes the hierarchical relationship between the variables defined so far.

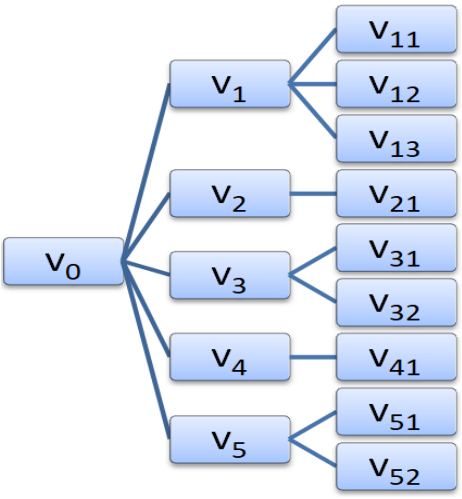

Figure 1: Schematic representation of the hierarchy between the variables shown so far

The relevance of EDUCOM-DIGITAL lies in its ability to integrate theory, practice, and social impact into an innovative teaching model. By developing accessible and effective strategies for incorporating podcasts into

higher education, this project will not only transform learning dynamics at SEPSU but will also serve as a reference for the implementation of similar initiatives at other institutions, thus strengthening the digital educommunication ecosystem in Latin America. Additionally, the potential impacts of the project will be considered as variables, as indicated below.

Scientific Impact (Denoted by v_i): This research will contribute to the advancement of knowledge in educommunication and digital learning by analyzing how podcasts can be an effective tool for bridging gaps in digital and communication skills. This is because their versatility allows them to run on various operating systems and multimedia devices, which favors their inclusive nature in the academic field. Furthermore, it will allow for the validation of innovative teaching and scientific dissemination methodologies in educational contexts with technological limitations. The results of this study can be used as a reference in future research on the integration of digital tools in higher education.

Social Impact (Denoted by v_{ii}): The project seeks to strengthen educational inclusion by providing equitable access to academic and scientific outreach content in accessible formats. Scientific outreach is on the rise, but with greater emphasis in developed countries, while in Latin America it is just beginning. Therefore, improving the digital and communication skills of students and teachers is expected to generate a change in the way knowledge is accessed and shared in SEPSU and other institutions with similar characteristics. The dissemination of knowledge in a dynamic format will allow for the further democratization of education and science.

Economic Impact (Denoted by v_{iii}): Although the project does not have a commercial focus, its implementation could generate indirect economic benefits by reducing dependence on printed resources and encouraging the use of free technologies for the production and distribution of educational content.

Also, podcast production training can provide opportunities for students and teachers to develop entrepreneurial projects based on digital communication. This is due to the ease with which this tool can be integrated into various educational environments without the need for complex infrastructure, allowing users to develop skills in content production and dissemination with accessible resources.

Political Impact (Denoted by v_{iv}): The prevailing criterion in the knowledge society is that people can access and consult the multiplicity of existing sources, with the possibility of connecting to the Internet. In this sense, the study could influence university policies related to the adoption of digital educommunication strategies in higher education. The evidence generated will support the case for investing in technological infrastructure and in the training of teachers and students in digital tools to improve teaching and scientific dissemination. This could contribute to the formulation of new institutional strategies and public policies in digital education.

Influence on educational policies (Denoted by v_v): The results of the project can serve as a basis for promoting public policies that integrate innovative digital tools, such as podcasts, into the national education system.

Strengthening the educational inclusion agenda (Denoted by v_{vi}): The project will contribute to the national objectives of ensuring equitable access to education and digital inclusion, aligning with the government's development plans.

Cultural Impact (Denoted by v_{vii}): Podcast content may include elements of local identity and culture, promoting the rescue of traditions and values of the Santa Elena province.

Technological Impact (Denoted by v_{viii}): The research will drive the adoption of accessible and sustainable technologies for the production and consumption of educational digital content.

Ethical Impact (Denoted by v_{ix}): By promoting education free from violence and discrimination, the project will foster respect and ethics in digital educational environments.

Figure 2 visually represents the rest of the variables studied.

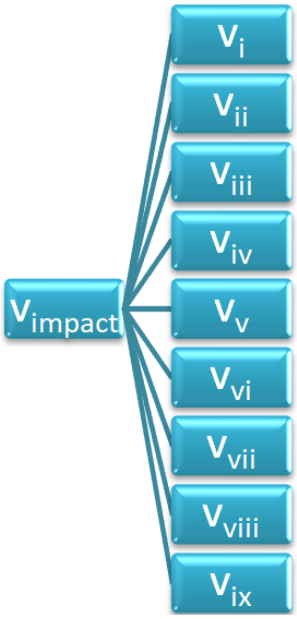

Figure 2: Schematic representation of the impact variables

A peculiarity of these assessments is that the scale extends beyond the classic interval $[0, 1]$. We will extend it to the interval $[-0.1, 1.1]$, we want to include the value -0.1 to differentiate it from 0, whose meaning is that the measured aspect is not only false for not meeting expectations but also produces negative results beyond those expected. On the other hand, the value 1.1 will indicate the opposite, not only that it meets expectations, but that there are indications of greater satisfaction with other variables positively. This is the interpretation for truthfulness, although there will be a particular interpretation for falsity and indeterminacy.

To make the scale easier to use by experts, they are asked to determine the degree of truthfulness, indeterminacy, and falsity of each variable based on a scale of 0 to 100. They are also told that they can evaluate the scale up to -10 or 110 if they find a variable that meets the explanation outlined in Table 1.

Table 1: Summary of possible out-of-range values [0, 100] for use by experts in the assessment

Value/ Meaning	**Veracity**	**Indeterminacy**	**Falsehood**
Between -10 and less than 0	It does not meet expectations and also causes additional losses.	It can be established whether it is true or false and there are additional clues that bring more clarity.	It meets expectations and also has additional advantages
Between greater than 100 and 110	It meets expectations and also has additional advantages	It cannot be established whether it is true or false and there are additional clues that bring more confusion.	It does not meet expectations and also causes additional losses.

One of the key aspects of the success of this model is that experts understand the meaning of the additional values explained in Table 1 and the difference in the explanations when it comes to truth, indeterminacy, and falsity.

So, the evaluations will consist of triples of values $(\mathrm{T}, \mathrm{I}, \mathrm{F}) \in [-0.1, 1.1]^3$, where the scale proposed to the experts in the range $[-10, 110]$ is divided by 100 to arrive at the proposed interval.

To convert the scores in the form of (T, I, F) to a single numeric value, the following score function is used:

$$\mathcal{S}_{off}\big((T, I, F)\big) = \frac{T+(\Omega-I+\Psi)+(\Omega-F+\Psi)}{3} = \frac{2\Omega+2\Psi+T-I-F}{3} \qquad (2)$$

This equation is equivalent in its deduction to that defined in [17] for Ω=1 and Ψ =0.

In our case, it is true $\mathcal{S}_{off}\big((T, I, F)\big) = \frac{2(1.1)+2(-0.1)+T-I-F}{3} = \frac{2+T-I-F}{3}$ that it is identical to the equation of the score function in the interval $[0, 1]$ that appears in [17].

In general, we propose the following procedure:

1. It starts from the expert evaluations, denoted by $\theta_{jk} = \big(T_{jk}, I_{jk}, F_{jk}\big)$, which is the criterion given by the jth expert $j = 1, 2, \ldots, n$; based on the kth indicator, where $k = 11, 12, 13, 21, 31, 32, 41, 51, 52, i, ii, iii, iv, v, vi, vii, viii, ix$.
   T_{jk} is the truth value,
   I_{jk} is the indeterminacy,
   F_{jk} is the value of falsehood.
   They are taken in the interval [0, 100], where 0 is zero veracity, indeterminacy, and falsity, respectively; and 100 means maximum veracity, indeterminacy, and falsity, respectively.
   They are also asked to consider values in the range $[-10, 0)$ and $(100, 110]$ with explanations of their meanings given in Table 1.
2. It is considered v_v the dominant criterion, that is $v_D = v_v$. We are primarily interested in the criterion of the project's influence on educational policies. However, managers can change v_D to another that is more appropriate depending on the circumstances.
3. Convert $\theta_{jk} = \big(T_{jk}, I_{jk}, F_{jk}\big)$ to $\tilde{\theta}_{jk} = \big(\tilde{T}_{jk}, \tilde{I}_{jk}, \tilde{F}_{jk}\big)$, where $\tilde{T}_{jk} = \frac{T_{jk}}{100}$, $\tilde{I}_{jk} = \frac{I_{jk}}{100}$, and $\tilde{F}_{jk} = \frac{F_{jk}}{100}$. This rescales it to the interval $[-0.1, 1.1]$.
   $c_{jk} \in [0, 1]$ are the dissimilarity values of each of the indicators concerning the dominant criterion, according to the jth expert, where $c_{jv} = 0$.
4. The values for all experts are aggregated using the arithmetic mean, that is:
   $$\widetilde{\Theta}_k = \left(\frac{\sum_{j=1}^{n} \tilde{T}_{jk}}{n}, \frac{\sum_{j=1}^{n} \tilde{I}_{jk}}{n}, \frac{\sum_{j=1}^{n} \tilde{F}_{jk}}{n}\right) \qquad (3)$$
   Dissimilarity values are aggregated for all experts using Equation 4,
   $$C_k = \frac{\sum_{j=1}^{n} c_{jk}}{n} \qquad (4)$$
5. For simplicity, the values in Equation 3 are converted into a single crisp value using Equation 5.
   $$\Lambda_k = \mathcal{S}_{off}\big(\widetilde{\Theta}_k\big) \qquad (5)$$
6. Each of these values is reconverted by comparing with the values of the dominant criterion and using the dissimilarity values in Equation 4. For this purpose, Equation 6 is used, [1, 2].
   $$\Xi_k = [1 - \mathrm{C}_k] \cdot \min(\Lambda_k, \Lambda_v) + \mathrm{C}_k \cdot \max(\Lambda_k, \Lambda_v) \qquad (6)$$
7. The following final results are obtained for each of the general criteria from the results of the subcriteria:
   $\bar{\Xi}_1 = \frac{\Xi_{11}+\Xi_{12}+\Xi_{13}}{3}$,
   $\bar{\Xi}_2 = \Xi_{21}$,
   $\bar{\Xi}_3 = \frac{\Xi_{31}+\Xi_{32}}{2}$,
   $\bar{\Xi}_4 = \Xi_{41}$,
   $\bar{\Xi}_5 = \frac{\Xi_{51}+\Xi_{52}}{2}$.
   And the impact values remain the same as:
   $\bar{\Xi}_i = \Xi_i$, $\bar{\Xi}_{ii} = \Xi_{ii}$, $\bar{\Xi}_{iii} = \Xi_{iii}$, $\bar{\Xi}_{iv} = \Xi_{iv}$, $\bar{\Xi}_v = \Xi_v$, $\bar{\Xi}_{vi} = \Xi_{vi}$, $\bar{\Xi}_{vii} = \Xi_{vii}$, $\bar{\Xi}_{viii} = \Xi_{viii}$, $\bar{\Xi}_{ix} = \Xi_{ix}$.
8. The general result is obtained with the help of Equation 7:

$$\Xi_0 = \frac{\sum_k \Xi_k}{18} \qquad (7)$$

Let us illustrate this model with an example:

Example 2: Suppose we have three experts who evaluate the EDUCOM-DIGITAL project on the aspects specified above. These evaluations are summarized in Table 2.

Table 2: Expert evaluation for each of the criteria on a scale within the interval [-10, 110]

Criterion/Expert	e_1	e_2	e_3
v_{11}	(88,3,21)	(64,3,18)	(48,-5,-4)
v_{12}	(69,2,-3)	(101,8,8)	(41,-4,33)
v_{13}	(68,1,3)	(108,6,9)	(43,-2,4)
v_{21}	(68,0,3)	(109,3,-5)	(41,6,33)
v_{31}	(64,3,0)	(108,3,28)	(41,5,38)
v_{32}	(82,3,-10)	(85,8,21)	(41,9,3)
v_{41}	(105,5,28)	(75,3,16)	(44,9,24)
v_{51}	(94,1,-3)	(83,2,-4)	(42,-6,27)
v_{52}	(80,3,2)	(90,7,7)	(50,-8,11)
v_i	(93,4,-9)	(63,10,-9)	(47,9,10)
v_{ii}	(85,7,8)	(109,10,9)	(45,-1,-2)
v_{iii}	(64,8,16)	(92,2,-3)	(42,1,34)
v_{iv}	(89,7,-6)	(63,2,-7)	(49,6,-9)
v_v	(72,1,28)	(80,7,26)	(40,-2,32)
v_{vi}	(70,3,-2)	(79,10,9)	(44,7,5)
v_{vii}	(85,1,5)	(100,7,7)	(48,-2,23)
v_{viii}	(92,9,-9)	(92,8,6)	(49,5,16)
v_{ix}	(102,3,-8)	(101,5,2)	(42,-1,32)

Table 3 contains the values from Table 2 rescaled to the interval [-0.1, 1.1] dividing them by 100.

Table 3: Expert evaluation for each of the criteria on a scale in the interval [-0.1, 1.1]

Criterion/Expert	e_1	e_2	e_3
v_{11}	(0.88,0.03,0.21)	(0.64,0.03,0.18)	(0.48,-0.05,-0.04)
v_{12}	(0.69,0.02,-0.03)	(1.01,0.08,0.08)	(0.41,-0.04,0.33)
v_{13}	(0.68,0.01,0.03)	(1.08,0.06,0.09)	(0.43,-0.02,0.04)
v_{21}	(0.68,0.00,0.03)	(1.09,0.03,-0.05)	(0.41,0.06,0.33)
v_{31}	(0.64,0.03,0.00)	(1.08,0.03,0.28)	(0.41,0.05,0.38)
v_{32}	(0.82,0.03,-0.10)	(0.85,0.08,0.21)	(0.41,0.09,0.03)
v_{41}	(1.05,0.05,0.28)	(0.75,0.03,0.16)	(0.44,0.09,0.24)
v_{51}	(0.94,0.01,-0.03)	(0.83,0.02,-0.04)	(0.42,-0.06,0.27)
v_{52}	(0.80,0.03,0.02)	(0.90,0.07,0.07)	(0.50,-0.08,0.11)
v_i	(0.93,0.04,-0.09)	(0.63,0.10,-0.09)	(0.47,0.09,0.10)
v_{ii}	(0.85,0.07,0.08)	(1.09,0.10,0.09)	(0.45,-0.01,-0.02)
v_{iii}	(0.64,0.08,0.16)	(0.92,0.02,-0.03)	(0.42,0.01,0.34)
v_{iv}	(0.89,0.07,-0.06)	(0.63,0.02,-0.07)	(0.49,0.06,-0.09)
v_v	(0.72,0.01,0.28)	(0.80,0.07,0.26)	(0.40,-0.02,0.32)
v_{vi}	(0.70,0.03,-0.02)	(0.79,0.10,0.09)	(0.44,0.07,0.05)
v_{vii}	(0.85,0.01,0.05)	(1.00,0.07,0.07)	(0.48,-0.02,0.23)
v_{viii}	(0.92,0.09,-0.09)	(0.92,0.08,0.06)	(0.49,0.05,0.16)
v_{ix}	(1.02,0.03,-0.08)	(1.01,0.05,0.02)	(0.42,-0.01,0.32)

Table 4 contains the average of the evaluations for all experts.

Table 4: Average of the evaluations for each criterion for all experts

Criterion	Average value aggregated
v_{11}	(0.667,0.003,0.117)
v_{12}	(0.703,0.02,0.127)
v_{13}	(0.73,0.017,0.053)
v_{21}	(0.727,0.03,0.103)
v_{31}	(0.71,0.037,0.22)
v_{32}	(0.693,0.067,0.047)
v_{41}	(0.747,0.057,0.227)
v_{51}	(0.73,-0.01,0.067)
v_{52}	(0.733,0.007,0.067)
v_{i}	(0.677,0.077,-0.027)
v_{ii}	(0.797,0.053,0.05)
v_{iii}	(0.66,0.037,0.157)
v_{iv}	(0.67,0.05,-0.073)
v_{v}	(0.64,0.02,0.287)
v_{vi}	(0.643,0.067,0.04)
v_{vii}	(0.777,0.02,0.117)
v_{viii}	(0.777,0.073,0.043)
v_{ix}	(0.817,0.023,0.087)

Table 5 summarizes the results of the dissimilarity function for each of the experts and the average for all experts.

Table 5: PCF values for each expert and average

Criterion /Expert	PCF according to e_1	PCF according to e_2	PCF according to e_3	Average PCF
v_{11}	0.9	1.0	1.0	0.967
v_{12}	0.1	0.1	0.1	0.1
v_{13}	0.2	0.2	0.2	0.2
v_{21}	0.2	0.3	0.5	0.333
v_{31}	0.1	0.2	0.4	0.233
v_{32}	0.1	0.2	0.4	0.233
v_{41}	0.2	0.3	0.4	0.3
v_{51}	0.3	0.4	0.6	0.433
v_{52}	0.4	0.6	0.7	0.567
v_{i}	0.3	0.3	0.3	0.3
v_{ii}	0.2	0.3	0.3	0.267
v_{iii}	0.4	0.5	0.6	0.5
v_{iv}	0.4	0.5	0.5	0.467
v_{v}	0.0	0.0	0.0	0.0
v_{vi}	0.2	0.4	0.5	0.367
v_{vii}	0.2	0.2	0.3	0.233
v_{viii}	0.1	0.2	0.2	0.167
v_{ix}	0.1	0.1	0.3	0.167

The results of the score function for the values in Table 4 are as follows:

Table 6: Results of applying the score function to the values in Table 4

Criterion	Score function applied to the aggregated average value
v_{11}	0.849
v_{12}	0.852
v_{13}	0.88666667
v_{21}	0.86466667
v_{31}	0.81766667
v_{32}	0.85966667
v_{41}	0.821
v_{51}	0.891
v_{52}	0.88633333
v_{i}	0.87566667
v_{ii}	0.898
v_{iii}	0.822
v_{iv}	0.89766667
v_{v}	0.77766667
v_{vi}	0.84533333
v_{vii}	0.88
v_{viii}	0.887
v_{ix}	0.90233333

The values in Table 6 are rescaled using Equation 6 about the value of the dominant criterion.

Table 7: Results of applying Equation 6 to the elements in Table 6

Criterion	Rescaled values using Equation 6
v_{11}	0.84662222
v_{12}	0.7851
v_{13}	0.79946667
v_{21}	0.80666667
v_{31}	0.787
v_{32}	0.7968
v_{41}	0.79066667
v_{51}	0.82677778
v_{52}	0.83924444
v_{i}	0.80706667
v_{ii}	0.80975556
v_{iii}	0.79983333
v_{iv}	0.83366667
v_{v}	0.77766667
v_{vi}	0.80247778
v_{vii}	0.80154444
v_{viii}	0.79588889
v_{ix}	0.79844444

Table 8 contains the values of the aggregations for each criterion and the total.

Table 8: Results of aggregating the subcriteria for each criterion plus the total value

Criterion	Aggregated value
v_1	0.8103963
v_2	0.80666667
v_3	0.7919
v_4	0.79066667
v_5	0.83301111
v_i	0.80706667
v_{ii}	0.80975556
v_{iii}	0.79983333
v_{iv}	0.83366667
v_v	0.77766667
v_{vi}	0.80247778
v_{vii}	0.80154444
v_{viii}	0.79588889
v_{ix}	0.79844444
v_{Total}	0.80581605

Table 8 shows a final evaluation result for the project of 0.80581605, which is very adequate. The final values for each criterion are greater than 0.77, which is also very adequate.

4. Conclusion

The EDUCOM-DIGITAL project aims to design digital educational communication strategies through the creation of educational podcasts to reduce gaps in digital and communication skills, fostering inclusion, educational resilience, and scientific outreach at the Santa Elena Peninsula State University (SEPSU). Higher education faces significant challenges in terms of accessibility and equity, and digital transformation is a key factor in overcoming these barriers. In this sense, the implementation of innovative digital tools such as educational podcasts allows not only the dissemination of knowledge but also the promotion of interactive and accessible learning. This paper proposes to design a logical-mathematical model for the evaluation of the planned or ongoing operation of EDUCOM-DIGITAL. The model uses as input the evaluation of 18 indicators by one or more experts. The tool on which the model is based is Plithogenic Offsets, which combine variables of different types to be measured and also a scale for measuring truthfulness, indeterminacy, and falsity in the interval [-0.1, 1.1]. The Plithogeny theory allowed us to perform a multivariate analysis, while the selected interval allowed us to model situations where there are results of over-confirmation or over-refutation of truthfulness, indeterminacy, or falsity. To demonstrate the usefulness of the model, we illustrated with a detailed example.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

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Received: Dec. 25, 2024. Accepted: July 1, 2025