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# Semantic Correlation Model of Socio-Formative Data for Curricular Planning Evaluation

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**Abstract:** The study presents a semantic correlation model (SCM) of socioformative data, which is designed to support the evaluation of curriculum planning (CPE) that is developed from indicators derived from curriculum components such as graduate profile, study plan, area plan and subject plan. The objective of the research was to design a semantic correlation model of socio-formative data to support the evaluation of curriculum planning in accordance with the objectives of sustainable development in education. The study is a quasi-experimental research based in a Likert questionnaire applied on a group of 10 students (16 and 18 years old) belonging to the eleventh grade of the urban official educational institutions of Marsella, in the department of Risaralda in Colombia. The results indicate that the model has an impact on the evaluation of curricular planning, concluding that the design and implementation of a semantic correlation model of sociodemographic data does have an impact on the evaluation of curricular planning of a classroom subject in an educational institution in Marsella.

**Keywords:** *Curriculum planning; curricular evaluation; natural language processing; semantic correlation; socio-formative data.*

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## Introduction

This article is based on some of the main problems around the concept of curriculum such as conceptualization, implementation and diagnosis. Such problems clearly affect the development of a pertinent curricular planning with the needs and potentialities of the educational institution in which it is implemented (Niño Zafra et al., 2016). For this reason, the semantic correlation model is proposed, since it allows for maintaining coherence between the internal components of the curriculum and, in turn, the relationship between the material state of the surrounding context of the institution and the training objectives that curriculum planning must integrate. To understand such a proposal, it is necessary to approach each of these problems from the voices of different researchers.

Thus, in the case of conceptualization, Fonseca Perez and Gamboa Graus (2017) state that "the problem also lies in the need to have an adequate conceptualization of the curriculum and curricular design by the teachers in charge of materializing the changes" (p. 83). The same authors, propose that "it is very risky to start from an inadequate definition of the curriculum, since designing it on an ´indefinite` definition (without precise limits) generates an important curricular magma in their development" (Fonseca Perez & Gamboa Graus, 2017, p. 87). For the rest, Renteria Vera (2020) notes that the majority of works in which they propose to reflect on the concept of curriculum show that the lack of knowledge of the same concept in question among the educational community constitutes the first problem of the case.

In the end, the inaccurate definition of a concept or the lack of delimitation in a real study context directly affects its implementation since the choice between one approach and another is determined by the basic epistemological and ontological values. And it is that the presence of a fleeting concept of curriculum in the school context, has meant that it is not practiced with a significant degree of conceptualization, which is why many decisions and processes lack a foundation and, consequently, do not evidence particular results that respond to the demands of the context (Casanova, 2012).

Now, if on the one hand the problem is the lack of clarity about the concept of curriculum and, at the same time, curricular planning; on the other hand, the fact stands out that the vast majority of cases where there is a position on the subject,

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work is not based on a curriculum that adjusts and manages with the criteria stipulated from the specialized literature. This is what Fonseca Perez and Gamboa Graus (2017) stares when pointing out that "the direction of the teaching-learning process has to be carried out in a scientific manner and this cannot be improvised, under any circumstances" (p. 86). In this way, it can be said that as long as the concept of curriculum continues to include new concepts, motives and perspectives to the basic notion, the possibility of normalizing principles and building indicators becomes more difficult. This contrasts with what Diaz Villa (2015) stares when pointing out that:

> In the 1960, in the light of the dominant concept of planning, the curriculum broadened its horizons to include: diagnosis of needs, objectives, learning experiences, evaluation of objectives, etc. From being the what (content), the selective principle of the curriculum, we went on to include a large number of components, which is what means that there are no limits to the concept, nor limits in terms of its objects. What initially, in an instrumental way, was defined as the what, was expanded and continues to be expanded with new notions that arise in the face of new concepts of life, education and work (p. 24).

In this sense, the implementation of the curriculum and its functionality tend to be restricted when conceptual clarity is not present among those in charge of guiding the process.

And it is that when turning towards the perspective of Jauregui Mora (2018), for whom the curriculum should be recognized as a "social construction that revolves around the experiences of a community to satisfy the demands of those who interact and dialogue with each other, mediated by a context" (p. 3) one ends up understanding that the curricular implementation becomes ineffective not only when there is a lack of theoretical and conceptual training, but also when this lack affects the understanding of the social environment in which it is implemented.

The foregoing allows revealing another of the problems faced by the curriculum, which, as García (2002) warns, corresponds to the perception of it as an abstraction of conceptual, methodological, and thematic elements that can be replicated year after year, without an evaluation of its scope or a reflection on its relevance. In accordance with the above, it is appropriate to return to Fonseca Perez and Gamboa Graus (2017) for those who, in relation to the curriculum, "a diagnosis is not made or the diagnosis that is made is insufficient and does not provide the necessary information to know the reality of the group and individual of their students" (p.85).

To understand this problem line, it must be remembered that the curriculum supposes a proposal related to the historical moment, which finds meaning in the context of the events that occur in close proximity to the community served by the institution. Jauregui Mora (2018) clearly states it when he indicates that "the curriculum must be designed according to real circumstances of a social and educational group in close relationship with daily practice" (p. 68). What calls for a practice of constant evaluation of the curriculum that helps to integrate the changes that are presented in the context, and translates them into a list of performances, goals, and coherent strategies and according to the needs. Thus, promoting actions with their backs turned to the historical moment, seems like a way to make the needs of the population invisible, and a way that what is established tends towards results that will be incompatible with the current state of affairs.

According to the above, it is worth mentioning Rodríguez and Aguilar (2017), who recognizes the need for institutions to have a methodology that serves to diagnose the coherence of the curriculum in the face of the experiences and resources of the context:

> ... the proposed methodology must include an internal and external evaluation of the curriculum described by Diaz Villa (2015), where the internal evaluation is aimed at defining the academic achievement of the students and the factors that are related to it (...) the external evaluation of the curriculum, allows knowing and judging the achievements of the curriculum in a general way. Here, the impact of the graduate on society and the achievement of the professional profile is evaluated by solving problems in their social and work environment. (p. 7)

A look at the above contrasts with a situation in which the classrooms are disconnected from the contexts in which they are located, and the former, in turn, are elusive in the vast majority of cases to the judgment of the students (Navarro-Corona, 2017).

This leads to note that curricular planning and teaching action are on separate paths and that their distancing is not convenient for any area of the educational institution. For the rest, an approach between the subject and the context for which it is planned makes it possible to specify the conceptual relationships between the subject, themes, and objectives, and thus give rise to a logical and rigorous teaching practice. To achieve such conceptual precision, it is necessary to make use of computer tools that, based on data and calculations, allow to delimit the semantic value of the same words and concepts used in planning and thus design, plan, and evaluate curricula with internal and external coherence.

## Literature Review

For the presentation of the theoretical references that make up the investigative proposal, the variables used in the research are divided into the minor concepts that compose them, so that they can be approached from the specific to the general. Thus, the evaluation of curricular planning understood as the dependent variable, is approached from the notions of curriculum and evaluation of curricular planning. For its part, the semantic correlation model of socioformative data that represents the independent variable is approached from the notions of the semantic correlation model and socioformative data.

*Curriculum*

In the case of this work, the curriculum is understood as a structure of theoretical, conceptual, and methodological relationships on which the educational project of an institution, its institutional horizon, the training proposal, and the guidelines for teaching practice are adjusted (Rangel Torrijo, 2015; Mendoza Moreira & González Palacios, 2015). For the rest, the curriculum responds to a meeting point between the educational, pedagogical, didactic, and didactic-specialized discourse. Each of these theoretical levels is incorporated into each other, which promotes an integrated vision of the curricular structure that, ultimately, constitutes the epistemic basis of curricular design (See Figure 1).

In the educational context of basic and secondary schooling, the curriculum integrates four areas that function as the components of the same curriculum (See Figure 2). Now, whether it is called areas, components, or even dimensions, it is from each of these conceptual elaborations that the process of curricular design and planning of educational institutions at the basic and secondary level of formation in Colombia works. For the rest, it is agreed to call them 1) graduation profile; 2) study plan; 3) area plans, and 4) subject plans (Osorio Villegas & Herrera Pua, 2013; Martínez Márquez, 2015; Fonseca Perez & Gamboa Graus, 2017).

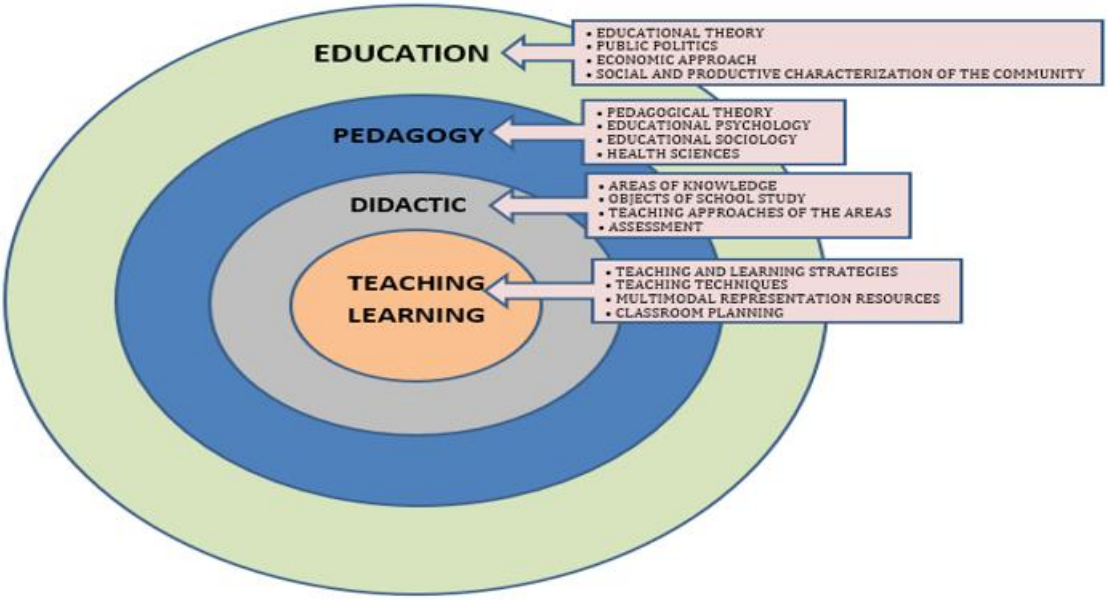


*Figure 1. Theoretical Levels of The Curriculum*

*Graduate Profile:* Thus, in the first place, there is the context of the educational institution and, from this side, the different problems and opportunities that shape the graduation profile and training of the student body. This area can be defined as a meeting point between the aims of education and the material state of the institutional context.

*Study Plan:* Next, there is the field of pedagogy, in which the construction of the institutional study plan is directed in convergence with the training objectives, the pedagogical model, the teaching-learning approach, and the hourly intensities.

*Area Plans:* Subsequently, the scope of the disciplinary areas is located, a place in which the epistemic reflection on the contents that are called school knowledge is installed. At this point, the object of study of the subjects can be found, in addition to the teaching and evaluation strategies used by teachers of the same area when proposing learning experiences in accordance with the subject and the area's approach.

*Class Plan:* Teaching practice is found at the first level of the entire curricular structure, an area in which both didactic knowledge and the different directions and clarities that allow guiding and facilitating learning are articulated. In addition to this, the skills of the teacher when planning learning experiences, the willingness and openness to situate and

re-signify teaching, their professional and intellectual training, among other factors directly related to the teacher, are added to this area.

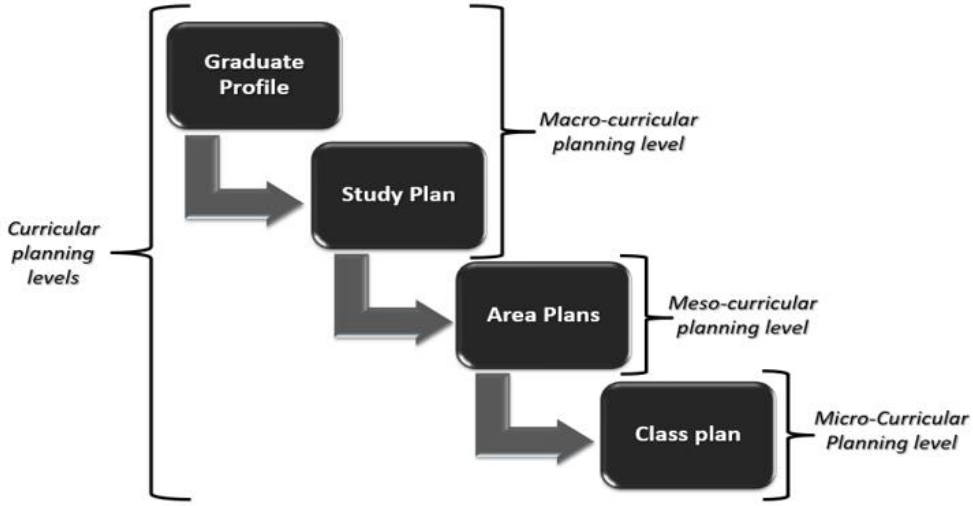


*Figure 2. Curriculum Structure*

*Evaluation of Curricular Planning*

It is necessary to define curricular planning as the intentional reconstruction of a curriculum and each of its components from a specific social context. This implies taking the curriculum from the simple theoretical structure to a real implementation proposal, in which each one of the components is adapted in a specific way until forming a proposal that responds, in a concrete way, to the needs and potentialities of the community and the institution. Indeed, the document that is obtained from this elaboration ceases to be a curriculum to become a curricular planning, since it already integrates a series of relationships and actions that respond to specific situations beyond the theoretical (Iafrancesco V, 2004; Aranda Barradas & Salgado Manjarrez, 2005; Morales Martínez et al., 2017).

Now, the evaluation of the curricular planning of one or several subjects is defined as the comparative review of the association of each one of the components of the curriculum with each other and, at the same time, the curricular planning in general with the characteristics of the institutional context (Diaz Villa, 2015). We speak of comparison, since it is necessary to use a reference that serves as an indicator, and helps to know to what extent it is associated or not with the characteristics of the context.

In the case of this research, the evaluation of curricular planning is taken as a process that begins in the educational community, since they are the ones who participate in the construction of the socioformative diagnosis of the context, after completing the macroeconomic perception questionnaire. The questionnaire is designed to identify trends in the institution's context in terms of problems and opportunities that most affect or benefit the community. The information obtained forms the socioformative data bank, the main input on which the semantic correlation model operates, and from which the graphs and indicators that guide the evaluation group when addressing curricular planning are produced (See Figure 3).

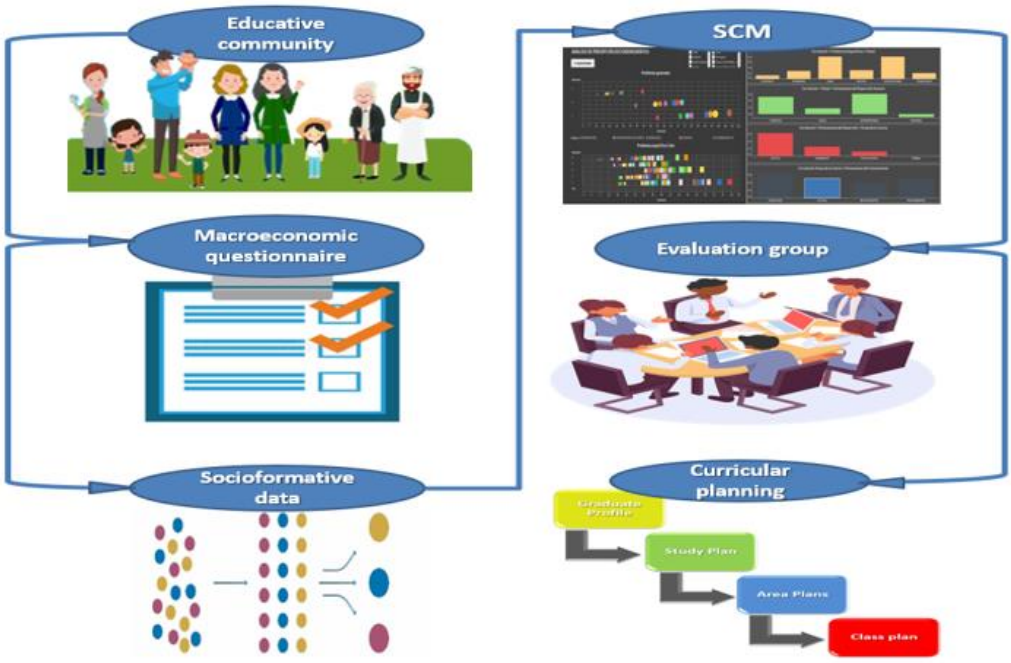


*Figure 3. Process of the Evaluation of the Curricular Planning*

*Semantic Correlation Model (SCM)*

To guide the evaluation of curricular planning, the present work develops the proposal of a semantic correlation model (SCM), which serves as a computer resource that projects the trend of educational training and the performances demanded by the institutional context from data collected from the educational community itself. The SCM is made up of four matrices, which, as mentioned before, represent the dimensions of the same model. Thus, we have: (a) the PESTEL matrix; (b) the matrix of dimensions of human development; (c) the knowledge areas matrix, and (d) the knowledge dimensions matrix. Since each of these matrices is a derivation of a curricular component, then the theoretical and conceptual perspective of each one is in tune with the field to which it refers. Similarly, all the matrices are sequentially correlated according to a specific pattern, which allows linking the second matrix with the first, the third with the second, and the fourth with the third, respectively. The first, for its part, is correlated with the opportunities and problems obtained from the context, foundational elements when building curricular planning (See Figure 4).

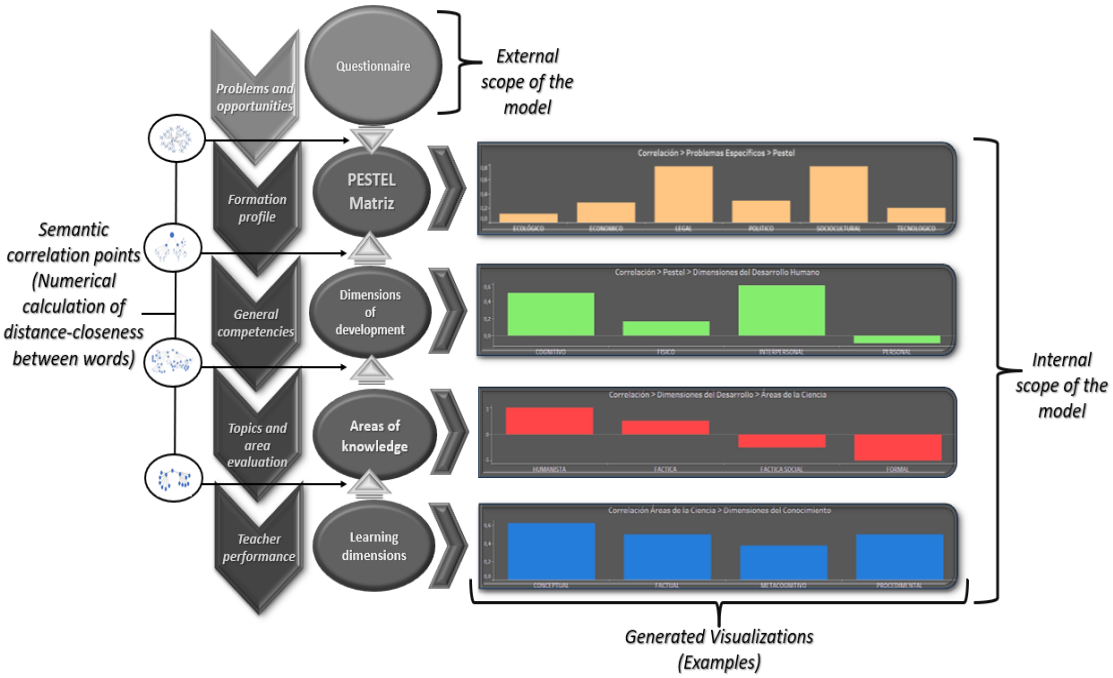


*Figure 4. Semantic Correlation Model*

However, the relationship between each of the levels of the curriculum and the SCM matrices constitutes one of the central points of the proposal. Thus, the PESTEL matrix is the component that addresses the graduate profile level, since it takes into account the information of a political, economic, sociocultural, technological, ecological and legal order, necessary to determine the relevance of the training offered in the institution. Next, the matrix of dimensions of human development is the component that represents the level of the study plan; hence it is made up of the four fundamental dimensions of formative and educational development: the physical, personal, interpersonal and cognitive dimensions. For its part, the matrix of knowledge areas is the component that coordinates the area plans in the curriculum, for this reason it delimits the four general areas of knowledge such as the formal, factual, social-factual and humanist area, according to their epistemic base. Finally, the matrix of knowledge dimensions is the component that focuses on the class plan, since it integrates the competencies in their conceptual, factual, procedural, and metacognitive dimensions (See Figure 5).

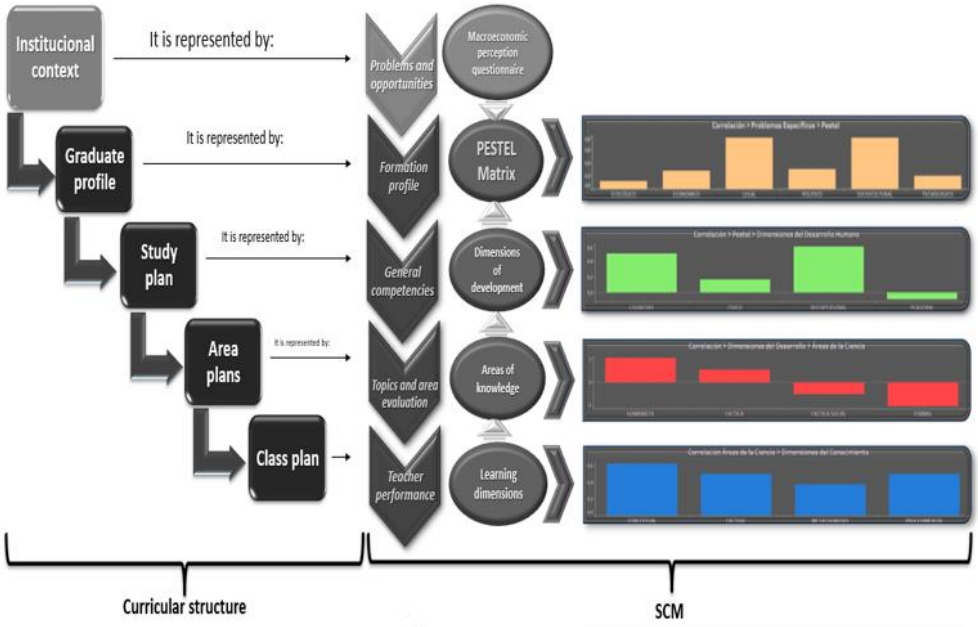


*Figure 5. Relationship Between the planning levels of the Curriculum and the SCM*

*Computing Perspective of the SCM*

In computer terms, the semantic correlation model (SCM) consists of a relational database composed of a multi-matrix structure that operates similar to a set of graphs on which different correlation values operate. This means that from each one of the problems or opportunities that are identified in the context, a different semantic correlation calculation is carried out that progresses sequentially between the matrices that make up the SCM, which allows, finally, that the problems and more relevant opportunities are linked to performances or more precise curricular directions in terms of sense or semantic value.

Precisely, since the SCM is an assembly in which the first matrix contains the next one, and this same one the next one and so on, it can be said that when a problem or an opportunity is closer to any of the PESTEL matrix concepts (the first in the structure) the following levels will be determined by this semantic closeness, which makes the SCM a succession of graphs calibrated by values (See Figure 6).

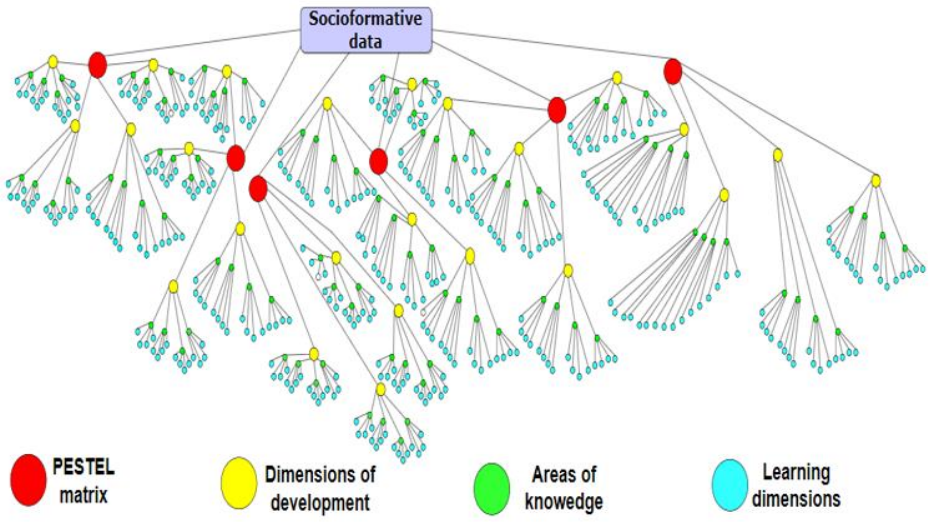


*Figure 6. Illustration of the Internal Structure of the SCM*

*Technical Perspective of SCM*

In technical terms, the SCM is a tool built on the Tableau visual data analysis platform (See figure 7, 8), and designed to help identify trends in educational training and curricular planning from the data obtained from a questionnaire. Socioformative perception that has been completed by a sample of attendees, teachers, students, and other participants of the educational community. The information obtained is the product of a socioformative diagnosis instrument that seeks to identify the perception of problems and opportunities. This information, when filtered through the matrices and their semantic correlations, allows obtaining visualizations that, later, will be used to guide the evaluation of curricular planning.

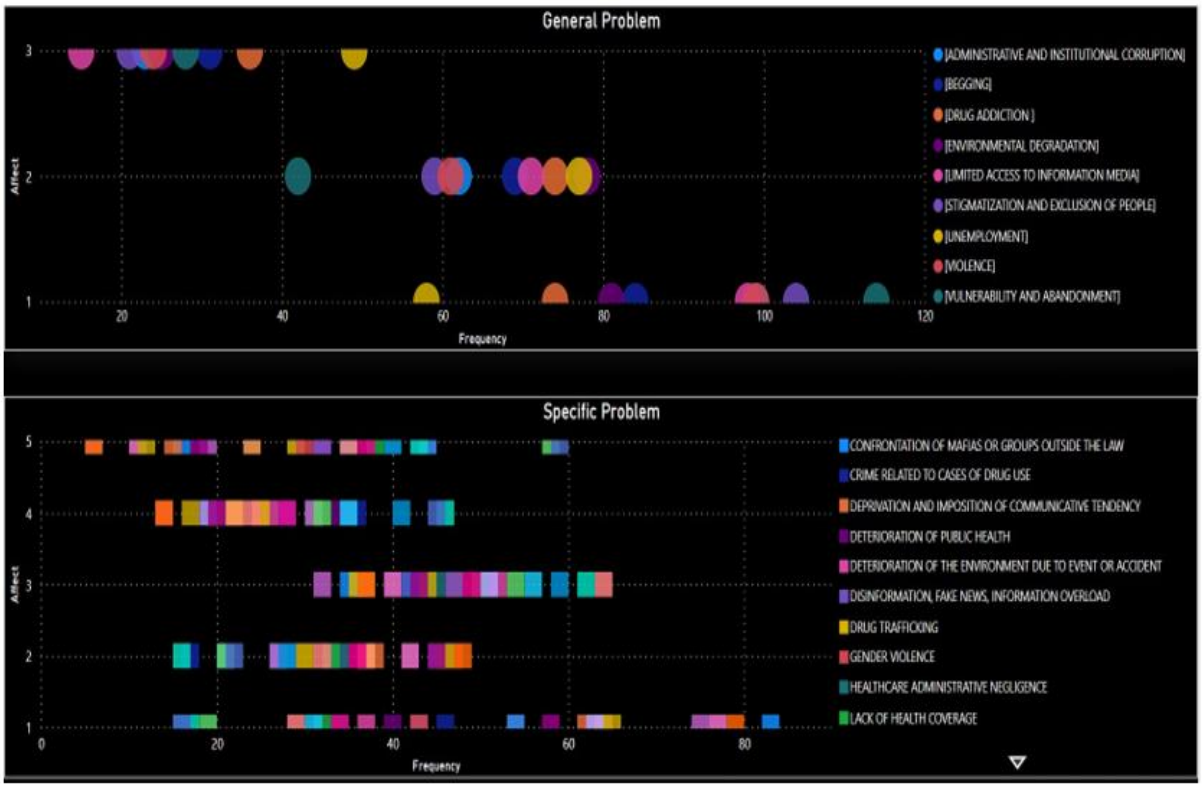


*Figure 7. Visualizations Semantic Correlation Model*


*Figure 8. Images of the SCM Dashboard in Tableau*

*Calculation of Semantic Correlations*

To calculate semantic correlations, the Semantic Reactor plugin is used (See Figure 9), which is available in Google spreadsheets, and works as a simple resource for the development of natural language understanding models (NLU) and natural language processing (NLP) (Velásquez Pérez et al., 2020; Rodríguez & Aguilar, 2017). This allows loading a bag of words made up of sentences and paragraphs that have been retrieved from the curricular orientation documents and, subsequently, organized as propositions in spreadsheet cells. Some of these texts correspond to the purposes of education from Law 115 (Colombian general education law), the basic concepts of the guidelines for the evaluated subject, the competence standards of the evaluated subject and the reference matrices of the evaluated subject, and other sources.

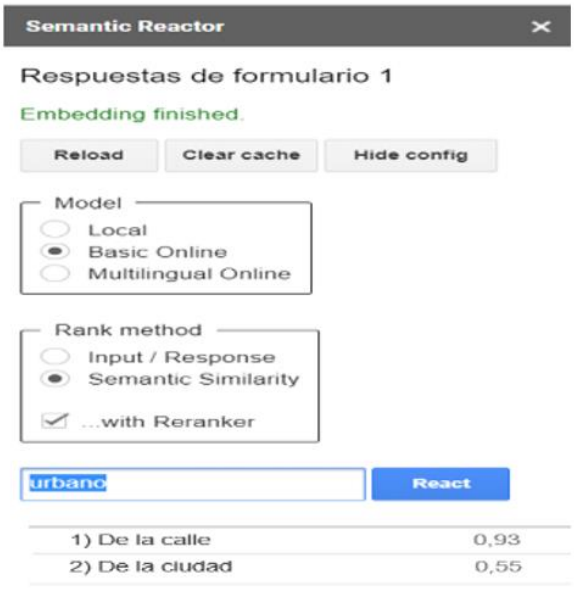


*Figure 9. Example Semantic Reactor*

After loading all the texts from which semantic relationships are to be established in an Excel file, the semantic reactor calculates how many times a word is related to another in relation to the semantic field, which allows it to produce decimal numbers that range between +1.0 to -1.0. A categorical example of the operation of the reactor allows us to point out that synonymous words are found near or at the +1 point, antonyms are near or above the -1 point, while non-relatable words or words with minimal semantic interaction are near or at point 0.

*Socioformative Data*

Socioformative data correspond to information that has an external origin to the institution and plays a cardinal role when it comes to guiding the decisions and proposals that are combined within the same institution. Such data focuses mainly on the external problems and opportunities of the institution, the rating trends conferred by the educational community, and the number and types of problems or opportunities that generate greater benefits or damages.

Indeed, the socioformative data are an approach to the characteristics of the context, since they represent the perception that the educational community has about the material state of the social environment in which they coexist (Ortega-Carbajal et al., 2015). Hence, they are the main input that will subsequently be correlated in semantic terms up to the level of skills and performance.

*Table 1. Data From the Macroeconomic Questionnaire About Problems*

| **Problems** | **Frequency Rate %** |
|---|---|
| Drug trafficking | 3 |
| Corruption of minors | 3 |
| Deterioration of public health | 3 |
| Deprivation and imposition of communicative tendency | 4 |
| Lack of spaces for critical participation | 4 |
| Prostitution | 10 |
| Administrative corruption | 10 |
| Destruction of the environment by eventuality | 10 |
| Violence linked to crimes and/or organized crime | 11 |
| Violence for ideological or racial causes | 11 |
| Microtraffick of drugs | 11 |
| Crime linked to cases of drug use | 11 |
| Confrontation of mafia or groups on the edge of the law | 11 |
| Stigmatization of community members by identity | 16 |
| Social exclusion/stigmatization due to ideology | 16 |
| Disinformation fake news, information saturation | 16 |
| Destruction of the public good | 20 |
| Systematic destruction of the environment | 20 |
| Restriction of creed vision of world or cult | 20 |
| Unemployment due to scarceness of productive resources such as land, inputs and credit | 22 |
| Gender based violence | 22 |
| Unemployment due to lack of specialized industry and/or development of extensive operations | 23 |

Due to the above, the socioformative data acquire a remarkable level of usefulness when it comes to evaluating and diagnosing an already implemented curricular planning. This is possible because such data, after being analysed and correlated in semantic terms, produce referential information that can be compared with what is presented as curricular planning for a subject. Such information incorporates references for each one of the dimensions of the curriculum, a fact that allows to probe the coherence between the different levels and the entire set of curricular planning according to the context for which it was designed.

*Table 2. Data From the Macroeconomic Questionnaire About Opportunities*

| Opportunities | Frequency Rate 2 % |
|---|---|
| State administrative infrastructure | 12 |
| Sports stage | 12 |
| National annual celebration | 9 |
| Large youth population | 7 |
| Proximity to the main city or urban center of the municipality | 7 |
| Traditional cultural events | 8 |
| Municipal honorary distinction | 8 |
| Ethnic Diversity | 5 |
| Quality village roads for the mobility of products and people | 3 |
| High productive specialization in manufacturing or craftsmanship | 3 |
| Significant specialization on agricultural or animal product | 9 |
| Existence of centralized administration collection centers | 12 |
| State help office | 9 |
| Health center or hospital | 8 |
| Associations in pro environmental / animal | 5 |
| Representative art/technique of the municipality | 5 |
| Continuous intermunicipal transportation | 6 |
| History and Municipal curatorship | 9 |
| Broad political representation | 9 |
| Recycling and environmental impact reduction programs | 7 |
| High production of agricultural products in the rural areas of the municipality | 4 |
| Diversity in agricultural productivity | 9 |
| Diversity in thermal scales for the development of various crops | 3 |

It should be noted that the problems and opportunities are located in a different area than the curricular structure, which, as already mentioned, has been nominated as an extracurricular element. The SCM captures this information from the macroeconomic perception questionnaire, a key instrument that is in an independent position from the other levels of the model, and its implementation depends on institutional agents.

## Methodology

The present investigation seeks to answer the question: How does the design and implementation of a semantic correlation model of socioformative data affect the evaluation of the curricular planning of a face-to-face subject in an educational institution in Marseille, Department of Risaralda, Colombia? Based on the response obtained, a positive or negative version of the following hypothesis can be adopted: The design and implementation of a semantic correlation model of socio-formative data affects the evaluation of the curricular planning of a face-to-face subject in an educational institution. of Marseille, Dept. Risaralda, Colombia.

For the development of this work, applied research of quasi-experimental design was carried out with a population universe represented by the total number of eleventh grade students of the urban official educational institutions of the municipality of Marsella, Department of Risaralda (Colombia), and a sample composed of 10 students from eleventh grade of the chosen educational institution, who also have the lowest number of absences from the class of the subject of Spanish and Literature.

Applied research is proposed since it is intended to improve a specific process, which in this case corresponds to the evaluation of the curricular planning of a subject. Likewise, a quasi-experimental design is proposed because the sample is not taken and organized randomly, but rather works with a sample that is already formed before the experiment. For these reasons, it should be noted that the term "quasi-experimental design" refers to a type of research design that does not fully meet the criteria of a randomized controlled experiment, but allows causal inferences to be made in a context in which the investigator cannot randomly assign participants to study groups (Arispe Alburqueque et al., 2020; Hernández-Sampieri & Mendoza-Torres, 2018).

### *Questionnaire*

A questionnaire designed based on the dimensions adopted in this work on curriculum and the indicators derived from the operationalization was used as an instrument. The same questionnaire is made up of 16 statements-indicators that the student must qualify among 5 Likert-type options, which propose a diagnostic relationship option (nothing, little, regular, a lot, quite a lot) between each of the dimensions that make up the planning curriculum of a given subject and the characteristics of the socio-educational context of the institution. In this case, students must remember the work

done during the last period in the classroom, in addition to the social environment in which they live and, from there, qualify the relationship.

*Observation Guide*

An observation guide was also used; whose observation unit is to attend to the operation of the SCM. In this unit, we seek to guide the interaction of students with the graphs generated by the SCM and, at the same time, promote understanding of how the model represents the different dimensions of the curriculum. For this, four sequential moments are proposed that guide the student through descriptions of the concept of curriculum, the operation of the SCM, the semantic correlations and the evaluation of the Spanish subject accompanied by the SCM.

The implementation of the observation guide was carried out in a two-hour work session, which took place two days after the students evaluated the curricular planning of the Spanish subject for the first time. To do this, the chosen students were taken to the institution's computer room and independently located on a computer that had previously been installed *Tableau* and, therefore, could run SCM. From there, each of the actions was carried out following the order of the observation guide. In the first 30 minutes of the session, a presentation was carried out in which the concept of semantic correlation model was described, with examples and the use of simple words, and the use made of the model when evaluating a curriculum. In the second period of 30 minutes, a presentation was made on the concept of curriculum, in which fundamental notions such as curricular dimensions, the articulation present between each dimension and the mechanism as the formative process is derived from the problems and opportunities were addressed from the context until reaching the actions inside the classroom. After the first hour, a 10-minute rest space was generated, which concluded with the beginning of the implementation of moment 3 of the guide. This was developed during a period of 15 minutes, and consisted of reviewing the results of the sociodemographic questionnaires and how the information generated from this instrument allowed the identification of a series of particular trends typical of the context. The remaining time allowed students to understand how the graphs generated from the SCM represent the trends previously identified in the socio-formative instrument, and how they manage to translate into a series of indicators that represent what should be addressed in the subject, at what times should to be addressed and coherently for what purposes it should be addressed. Throughout the session, questions were generated by the students, which were answered one by one in order to generate a general understanding of the topic. After the two hours, there was a space for the collective construction of conclusions and a formal closure of the session.

*Validation Process*

The validation process of both the questionnaire and the observation guide involved a group of ten judges with PhDs in education, located in both Colombia and Peru. Once contacted, they were asked to evaluate both instruments using a grid provided by the Norbert Wiener University (Perú) for instrument evaluation. In the case of the questionnaire, this grid allowed each question of the instrument to be qualified using a dichotomous option (From 0 to 5) for the pertinence, relevance and clarity criteria. For the observation guide, a suggestion space was provided linked to different moments described in the guide, where the judges could leave specific notes.

In addition, each judge was asked to share their opinion on the applicability of both instruments, using the options "applicable", "applicable after correction" and "not applicable". Finally, a homogeneous position was evidenced by each of the juries on the instrument, a fact that gives validity from a specialized position. These results finally contrast with the implementation of the Cronbach's Alpha formula that was applied to the questionnaire and that gives it a validity of 0.90, which qualifies it as an "Excellent reliability" questionnaire.

*Research Data Analysis*

After implementing the questionnaire twice to the same sample, interceded by the execution of an observation guide made up of four steps, the corresponding data contrast was carried out from descriptive and inferential statistics. Regarding the use of descriptive statistics, comparative bar graphs are used, which admit the parallel location of the data linked to each student, dimension of analysis and test. Regarding inferential statistics, the Wilcoxon test was used. This is defined as a non-parametric test that operates from data that is the product of an ordinal and distribution-free measurement. This test allows working with non-random sampling and related groups, characteristics of this research.

To calculate the Wilcoxon test, the lowest classification obtained from the sum of the positive and negative classifications in each of the dimensions analyzed is taken as the value of W. Thus, after adopting a specific error range (0.05 in the case of this work), the value linked to the error percentage (5%) described in the Wilcoxon table with the same number of the sample is taken, which at final allows obtaining the critical value. When there is a value of W less than the critical value provided for the sample number, the null hypothesis is rejected and the working hypothesis is validated.

**Results**

From descriptive statistics, the mean, mode, and median of the four dimensions analyzed show that there is downward mobility between the results of the entry test and the exit test. The results presented at this point, regarding the entrance and exit test, show a degree of incidence that operates downward, since in almost all cases the qualification given by the students to each of the questions of the different dimensions, varies in lower grades from the first to the second moment.

From the same descriptive statistics, a general trend can be observed among the students represented by an initial positive evaluation of the curricular planning of the subject, which changes significantly in the second evaluation and after students participate in the observation session with SCM (See Figure 10).

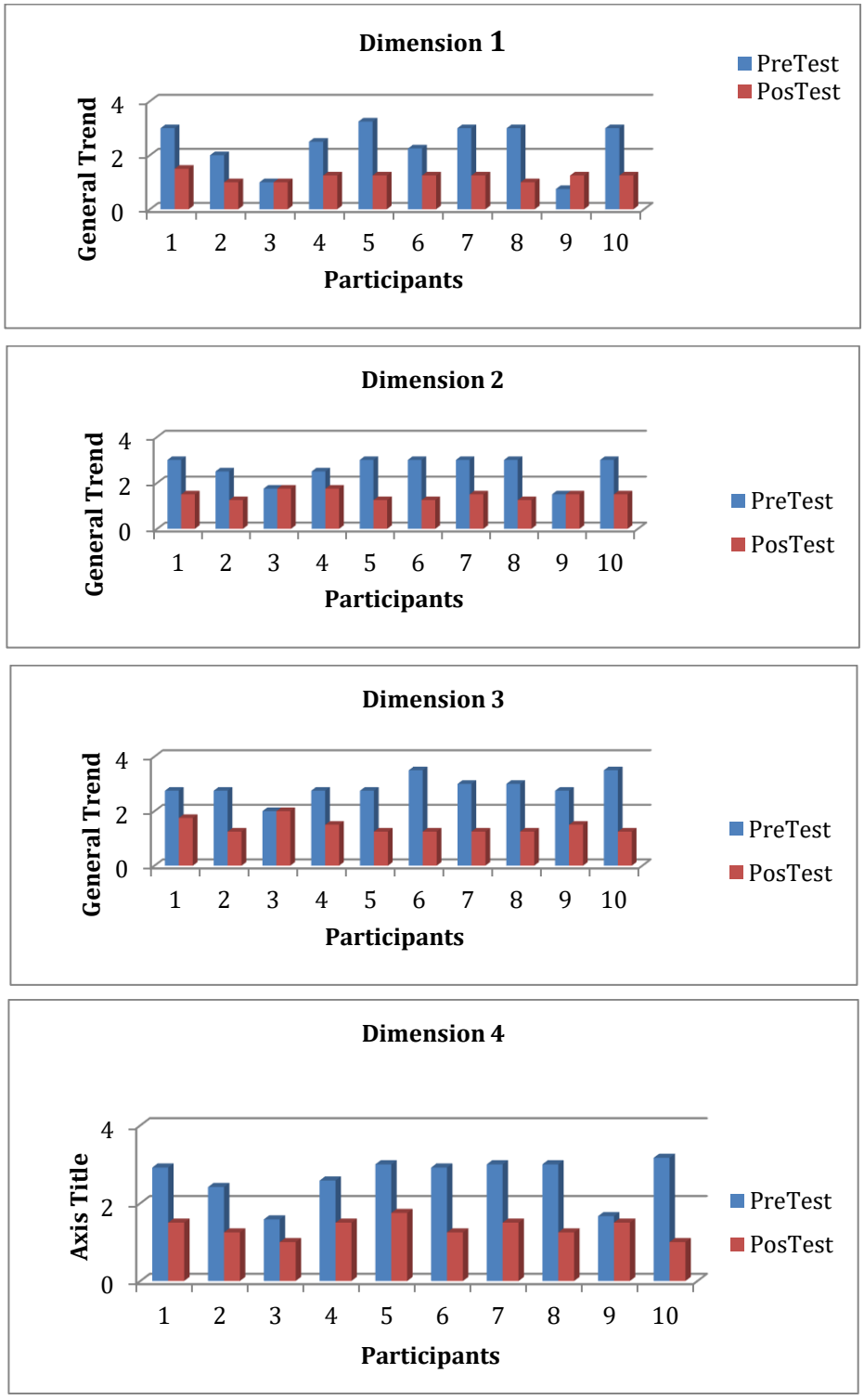


*Figure 10. Results of Descriptive Statistics for Every Dimension*

The foregoing allows us to assume that, when there are no data or guidance references for the evaluation, students have a greater predisposition to share a positive perception of the indicators analyzed. This situation reveals a prevailing degree of subjectivity in the evaluation process, a fact that changes significantly after noticing the differences between the indicators of the evaluation of curricular planning and the information projected by the SCM.

The graphs that are presented of descriptive statistics of the four dimensions evaluated, show the difference in the responses of each of the ten students before and after participating in the work with the SCM. This allows us to understand the presence of important changes that differ in some cases but, in general, remain as a sample of the incidence.

From inferential statistics, it is possible to identify a degree of significant variation from the results obtained in the first and second implementation of the questionnaire. Such results allow us to test hypotheses for the final adoption of one of the proposed hypotheses. According to the data obtained, the value of W of all the dimensions is 0, since this is the lowest classification that was obtained from the sum of the positive and negative classifications, respectively. Now, considering that the error range is 0.05, the critical value is taken from the Wilcoxon table which, linked to the percentage of error (5%), is found in the same number of the sample (10), which results in a critical value of 8. Thus, having a value of W less than the critical value expected for a sample of 10 people, the null hypothesis is rejected for each of the dimensions of the evaluation of curricular planning. For this reason, the working hypothesis is validated for all dimensions and work in general.

According to the descriptive data presented so far on each of the dimensions, it is clear that the incidence of the SCM operates in a decreasing manner in the vast majority of cases, which leads us to suspect that the influence of the SCM on students is unrelated to the simple eventuality, to then give rise to an instance of reflection that ends up showing that the subject and the curricular planning period do not respond, from the perception of the students, to what it should be. For the rest, it seems that the development of this judgment is the product of an evaluation process that was accompanied by the SCM and, in particular, the graphs that are projected from the crossing of the socioformative data and the final results obtained from semantic relationships.

Now, it should be noted that after analyzing the values of the four means obtained in the entrance tests, it can be identified how they are on the rise between each of the dimensions (2.375/ 2.625/ 2.875/ 2.98), an important fact that highlights a degree of decimal difference of almost 0.6 points between the first dimension and the last. However, a detail to take into account about the decreasing incidence that is identified in the results of the exit tests is that the range of decimal difference present between each of the averages of means of the entrance test is less than the output test (1.2/ 1.45/ 1.425/ 1.2), which is not greater than 0.2 decimal points. It is presumed, therefore, that the incidence of the SCM would be represented in the development of a more rigorous evaluation in which, at the same time, there is a lower level of uncertainty in the response.

The foregoing can be complementary to the analysis of the mode of the four dimensions, since it is evident the regularity that is maintained in the average values of the mode both in the input test and in the output test. Thus, after comparing the mode values in each of the dimensions of the input test (3/3/2.75/3), and the mode values in each of the dimensions of the output test (1.25/1.25-1.50/1.25, 1.50), once again a tacit confirmation emerges of the decreasing incidence that SCM has on the evaluation process of curricular planning.

Another point to consider is the one that has to do with the results of the Classroom Plan dimension, whose dimension obtained the highest evaluation average in the entrance test, but it is at the same time the dimension that had the lowest evaluation average in the exit test. As a result, the Classroom Plan dimension is the one with the greatest difference between the evaluation result before and after working with the SCM.

Indeed, it is believed that part of these results constitutes an important contrast between what the students perceive in the classroom, and what the SCM projects from the graphics and that coincides with what is supposed to be carried out by the teacher inside the classroom. Thus, when talking about the classroom plan, a dimension that directly incorporates student interaction, the results of the entrance test show a perception that is closer to the *in-situ* recognition of the training experience, rather than a vision evaluation consistent with rigorous evaluation criteria. In other words, the students are correct in qualifying the items of the evaluation on curricular planning from a face-to-face experience subject to the classroom and their own occurrences, however, they differ from these results after recognizing the differences that exist between the criteria of curricular evaluation and what is actually done inside the classroom.

In contrast, the above allows us to infer why the Graduate Profile and Study Plan dimensions have the lowest average values of difference between the entry test and the exit test. Well, although the downward trend between the entrance test and the exit test is maintained, the results of the first test do not show an approval as broad as that of the classroom plan, since in this case there is not an experience as close to students to the first two. As a result, the indicated dimensions are those that show the least difference in results in the evaluation before and after working with the SCM.

## Discussion

The use of information derived from the perception that each of the residents has of their context and the subsequent use of it by the SCM, gives significance to each of the graphs that the students had the opportunity to see. It is likely that for this reason the students, when comparing the curricular planning of the subject with the type of content that had to be worked on in class, found a difference that is clearly represented, finally, in the grade they give of the subject in the postest. This observation is similar to that proposed by Gomez-Aguilar et al. (2014) who, from the analyzes they carry out of the word clouds obtained from the contents of the student forums, go on to propose topics, tools and activities that are closer to the students, which, in effect, have a greater impact on the tastes and interests in class of the same students.

Another situation to take into account focuses on the fact that many of the graphs acquire a level of significance for people who are not professionals in analytics, as is the case with students. Even without having total clarity about the reason for the graphs and the comparison made between these graphs and the curricular planning of the subject, the students were able to correctly identify the closeness and/or distance that was established between the curricular planning and the socio-formative data of the context. This observation is similar to that raised by Muslim, who points out that many of the current educational platforms provide very useful information for stakeholders, and that students, especially, are among the people who most like to work with dashboards and identify the graphic proposal that these provide (Muslim, 2018).

The need to bring the analysis of educational data closer to a population without technical training corresponds to one of the main trends that are approaching regarding the area in question. Thus, being aware of this situation, the development of the SCM is carried out according to limited, low-cost resources and with time and investment requirements accessible to any educational institution. Chatti et al. (2013) point out that promoting access to educational data analytics to a larger population requires taking this objective to other situations such as data retrieval, integration of different sources, real-time operation, and use of metrics and indicators, among other areas linked to the practice of analysis.

The use of socio-formative data for the development of analysis models for educational purposes allows us to understand the consistency that each one of the dimensions of the curriculum must have with each other, according to the objectives proposed from the profile objectives. The understanding of the relationship that is articulated in this point, supposes the possibility of managing the curriculum in coherence with the needs of the educational community, as well as a way of integrating other data samples that are generated between each dimension and that in their majority, has not been addressed. Regarding the above, Charleer et al. (2018) speak of other sources of information that allow broadening the vision of the process in all its generality, and that usually derive from the actions of the students, the interactions of the students themselves within the courses, or the patterns of behavior that are identified in large information banks.

In addition to the above, authors such as Monroy et al. (2014) point out that the integration of learning analytics into the design and evaluation of curricula can significantly help to understand the changes in the study plan throughout the year. At the same time, a solid data strategy allows to carry out the recovery and use of data generated from mobile devices, computers, and other technologies of work inside the classroom. All this will be represented in a broad degree of knowledge that is oriented to the improvement of educational practice, the accompaniment of students according to the dynamics of performance, the identification of the success obtained according to the different strategies and tools, in addition to the understanding of patterns embedded in the implementation of the curriculum (Monroy et al., 2014).

Possibly, the participation of the educational community has one of the most important roles in the evaluation of curricular planning, together with the socio-formative data, since, in what refers to the latter, they collect the perception that one has about the context. Indeed, the data collects the voice of the communities and, in that order of ideas, they acquire meaning before the same community according to the experience and knowledge that the latter have about their daily practices. The SCM recovers the categories of such perceptions and manages to give them a weighted meaning in relation to each curricular dimension, however, this process is incomplete without the vision of the community, who are finally the ones who give value to the graphs in contrast to what is done in the classroom. Aristizabal Fuquene (2017) reaches a similar conclusion when he points to the enormous contribution that pedagogical actors make to the discourse of learning analytics. Indeed, the data acquire a greater perspective when the person who reflects on it looks at it from her own role.

Overcoming the traditional utility that is usually given to data, and which is linked exclusively to the monitoring of academic results per student, is ultimately one of the main goals of the analytics process in the educational field. Therefore, it goes without saying that an administrative culture committed to growth must promote the use of data in each of the processes without taking it to the exclusivity of a single process. Indeed, the implementation of actions supported only by tradition, intuition or artifice, supposes a chapter that must be concluded in the different administrative spheres, and thus give rise to new actions that are carried out based on concrete information, empirical, historical and indexed. Aristizabal Fuquene (2017) points out that beyond the same data recovery, one of the key points continues to be the visualization of the same data, since this is the fundamental process that allows the information to acquire meaning in the eyes of the stakeholders. As such, these images not only serve as a means to represent phenomena that are not foreseeable to the naked eye, but also allow answers to concerns that originate in the very perception of the subject (Aristizabal Fuquene, 2016).

The curriculum components in their particularity must respond to a qualified and coherent design. As such, it is not feasible to have curriculum assemblies in which some of the components are not operational or are in contradiction with other components. The logic of the design must respond to several factors, among them the adoption of a pedagogical model that acts as the axis of institutional work. Freire Quintana et al. (2018) point out this element as foundational, so they aim to suggest that quality components designed from the requirements of a pedagogical model can generate quality curricular processes. In the opposite case, components that lack a logical relationship with other components, in the long run constitute evidence of the absence of a pedagogical model (Freire Quintana et al., 2018). Paradoxically, it is the students who can identify to a greater degree the discrepancies that may occur between the curricular proposals of the subjects and, at the same time, between the subjects themselves. Hence, the results obtained in the present work also become a point of reflection on the importance of having a model that is understandable by the participants, and convenient from the curricular structure.

In what corresponds directly to the semantic correlation model and its logical structure, some similarities can be proposed with investigative works that are found in the conceptual relationship between semantic calculation operations, natural language processing, curriculum and educational quality.

An example of the above is the use of combined data processing matrices and the calculation of semantic correlations used in the SCM, and the similarity found with the proposal for the automation of curricular queries based on the use of weighted heuristic classifications developed by MacAvaney et al. (2020). In general terms, researchers are advancing in study on the development of personalized curricular designs, which is why they propose a supervised deep learning model. However, unlike the SCM that serves as support in the evaluation of an already prepared curriculum, the researchers develop a system of evaluation and production of curricular plans with the objective of knowing which conditions are more efficient for the apprentices, according to the information that the latter share with the system. Thus, in the case of the SCM, the students who participated in the test evidenced a particular change in the way of assessing the curricular proposals, so a degree of understanding and judgment on the part of the students can be indicated regarding the planning that the teacher performed inside the classroom. Research by MacAvaney et al. (2020) corroborates a similar situation at the end of the research, after the group of learners recognizes the effectiveness in the gradual growth of the complexity of the curriculum that was proposed by the system designed for the research. At the same time, they point out the importance in the design of curricular proposals combined with particular characteristics of the context, which are articulated with data from surveys or labels provided by communities or social groups. In sum, the work of MacAvaney et al. (2020) manages to demonstrate a case of improvement of the curriculum by having heuristic classifications of data linked to the apprentices. The SCM ends up evidencing a case similar to the previous one, but it has the semantic correlations to achieve it.

In the same way, the SCM can help in the same way when identifying gaps or redundancies in curricular planning, as well as points in which the dimensions of curricular planning are not coherently integrated. The results obtained in both tests allow us to identify the change evidenced by the students' answers, after having considered what is done in class and the relationships that this has with higher levels such as the institutional study plan or the graduation profile that the educational institution intends to offer. This factor is similar to what was proposed in the work Al-Eyd et al. (2018), in which an investigative process is described that aimed to show the usefulness of a curricular mapping tool, implemented in the design of a study plan of a new medical school in the United States. Research by Al-Eyd et al. (2018) part of the construction of a database from sources linked to active learning practices, which allows to host information such as the title of the learning session, the sequence of the session, the clinical presentation of the week, the academic level of the students, the place of learning, the name of the faculty or the key words. Based on all the information collected, the system proceeds to verify compliance with the regulatory standards on medical education issued by a specialized committee in the proposed curriculum, which allows it to identify and point out specific situations regarding the integration of content, absences or repetition of content between different courses. The curriculum mapping tool demonstrates its usefulness when informing and guiding teachers and students on compliance with standards by medicine programs. Hence the relationship that can be found between the research by Al-Eyd et al. (2018) and the SCM, since in the latter it is presumed that the students understood the dynamics that the contents should have, as well as the sequential form between the objectives that the curriculum is framed in its different dimensions and, therefore, issued a different evaluative judgment in a previous and later moment on the curricular planning.

Regarding the area of semantics, it is necessary to remember how the daily life of educational processes is represented, first of all, in words. These are found in orality, discourse, textual exchanges or the different documents that are produced daily at all levels of the educational process. Indeed, the importance of the semantic value of words lies both in its founding nature of thought and the naming of the world, and in its central role in building the logical, cognitive, and scientific structure of people. In accordance with the above, the SCM uses semantic order data to be able to perform the different relationship and articulation. Thus, from the initial information on the problems and opportunities of the context and the derived semantic values, the SCM proposes particular guidelines on how the dimensions of the curriculum should operate, and what should be its general trends.

The foregoing coincides with the work presented by Hoppe (2017), which aims to compare two case studies of disciplinary groups from independent areas based on different data analysis methods that integrate, as the main factor,

information retrieval semantics techniques and detention of cohesive groups from network grouping relationships. The idea finally focuses on studying the way in which each disciplinary group builds knowledge among the participants, and how the nominative framework is established to achieve this objective. Hence, the author advances in an investigative sequence that allows him, first, to understand the network structures between users or user-devices; second, attend to the processes that use data sequence analysis methods and the effect relationship between them and, third, use of algorithmic treatments on content that allow mining techniques to be executed (Hoppe, 2017). One of the key points of this research is that in which part of the findings were obtained based on the semantic value of the words used by the group participants to define common problems from their areas. In the end, it is evident how the framework of understanding a problem is expanded, after identifying how different people interact around the same problem according to multiple expressions or nominations. In addition, similar to SCM, these experiences reveal relationships of the problem with other concepts that are often excluded or minimized (Hoppe, 2017).

One last detail to take into consideration is represented by the possibility offered by the SCM to guide actions that promote educational quality within the classroom. This is possible after understanding the usefulness of the SCM when evaluating teaching practice and its relationship with the quality benchmarks issued by the Ministry of National Education. Indeed, the SCM can help to understand how the dimensions of the curriculum are articulated between the different grades or educational levels, while helping to identify how much of what is planned in a specific area is being carried out, and how much of it reaches significant levels of the side of the situations of the context and quality referents. An example of this emerges after comparing the performances proposed by the teacher to work, and those proposed by the SCM, which leads to evaluating how much they coincide or not with each other. This particularity is similar to what is proposed in the work of Mandic (2022), who describes the proposal of software embedded in a platform, and which was designed for the curricular harmonization of the computer science area at different educational levels. For this, the researcher uses an ontological map built from the informatics curricular references that have been adopted in the educational context of the Republic of Serbia. Thus, the objective of the research was focused on evaluating the quality standard of computer science teachers at basic and secondary levels, in addition to identifying gaps or absences in the curriculum. For this purpose, specific referents were used that allowed calculating how much of what was planned in curricular terms coincides with the proposed referent, according to an analysis that focuses mainly on ontological mapping. This fact allows the researcher, finally, to point out in which disciplinary areas improvement actions should be promoted. In short, the relationship between the investigative work of Mandic (2022) and the SCM is clear, since both proposals agree as a mechanism for monitoring and improving teaching practice and curricular planning.

## Conclusions

The design and implementation of a semantic correlation model of socio-formative data does have an impact on the evaluation of the graduate profile dimension of the curricular planning of a classroom subject. This is based on the broad knowledge of the curriculum that goes from the theoretical understanding of the concept, curriculum design and curriculum planning, as a theoretical foundation within which the entire research and epistemic proposal is inserted. At the same time, the understanding of such concepts allows the abstraction of the relationships adopted by the work between each of the components, and the purpose sought with this integration.

Likewise, the incidence in the evaluation of the curriculum, area plan and classroom plan dimensions of the curricular planning of a classroom subject is demonstrated; which allow the construction of a wide and diverse panorama of the problems and opportunities of the context in relational databases and decision trees, which allow the development of the semantic correlation model with the functionality required for the work.

## Recommendations

With a view to improving research proposals similar to this one, we suggest continuing the construction of increasingly broader ontologies in different areas of educational knowledge and thus be able to advance in the development of specialized language models in education. The possibility of having a specialized model of educational order will help in the development of better evaluation processes, since it tends to reduce the level of uncertainty or subjectivity that is evident in processes such as curricular evaluation.

Likewise, to improve the research proposal, we suggest expanding and diversifying the participation of a greater number of agents from the educational community when collecting socio-formative data, since this allows building a broad and diverse panorama of the problems and opportunities of the context. This will be reflected in a broader and more complex projection of the context by the semantic correlation model and, to this extent, better references will be available when evaluating curricular planning.

From the point of view of the findings presented in this work, we suggest using the information obtained from the implementation of the instrument both for the improvement of processes within the class as well as those that are prior to the class process itself, such as planning of the area or the same institutional study plan proposal.

For future research, we suggest implementing questionnaires similar to those used in this work, but with the difference that, in this case, groups of teachers participate in the process. This would make it possible to identify how professionals

perceive their work and how this perception could change after the experience with a semantic correlation model that projects particular information from the context of the educational institution.

In the same way, we suggest for future research to limit the research process to a single dimension of the curriculum instead of its total planning. Focusing the observation process on specific dimensions can help to better understand how each dimension operates in the training process. In particular, it is recommended to promote greater observation in the dimension of the classroom plan, since it is there where the degree of articulation that the teaching practice presents with the institutional curricular proposal is reflected.

## Limitations

The main limitation encountered by the investigative process was of a technical nature. This situation occurred when the technological resources with which the model began to be developed, such as memory and processing, were not sufficient for the correct functioning of the model at the expected level. So, since there were some initial budget conditions and availability of resources, it was necessary to manage the solution to such problems, which meant in that instance a slowdown in the investigative process that, in turn, affected the schedule of implementations, analysis and other moments of the investigation.

A second limitation corresponds to the number of participants who were part of the process of implementing the socioformative questionnaire. The investigation started from the idea that all the parents of the educational institution in which the process was located participated in the questionnaire, which meant obtaining responses from an approximate number of 1200 people. However, being in a semi-rural area, not all parents had access to an Internet connection within the time and conditions required, which ended up limiting the number of participants to just under half the number initially projected (592). Likewise, it is necessary to indicate that the number of questionnaires that were answered was the necessary one to have a valid universe for the realization of the projections by the semantic correlation model.

### Ethics Statements

The study was approved by the ethics committee for data collection.

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### Conflict of Interest

There is no conflict of interest in the study.

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### Authorship Contribution Statement

Aristizábal: I carry out the theoretical framework, collection, and interpretation of the results. Huaita: I carry out the methodological framework and the discussion of the results. Yangali: Writing and critical review of the manuscript.

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