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Journal of Information Technologies and Communications

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Presentation of the Content

In the first article we present, *Model design to look for patterns related to suicide in social networks* by REYNA-MORÁN, Lizethe Guadalupe, LUNA-ROSAS, Francisco Javier and MEDINA-VELOZ, Gricelda, with adscription in the Instituto Tecnológico de Aguascalientes, as next article we present, *Tools to enable communication between sensor devices* by CUEVAS-RASGADO, Alma Delía, BRÖCKL, Ulrich, RODRÍGUEZ-AGUILAR, Rosa María and NIÑO-MEMBRILLO, Yedid Erandini, with adscription in the Universidad Autónoma del Estado de México and the University of Applied Sciences, as next article we present, *A didactic tool for updating the teaching-learning process of English as a foreign language* by FLORES-GONZÁLEZ, Norma, FLORES-GONZÁLEZ, Efigenia CASTELÁN-FLORES, Vianey and ZAMORA-HERNÁNDEZ, Mónica, with adscription in the Benemérita Universidad Autónoma de Puebla, as last article we present, *Process of staff activities National Electoral Institute in electoral jorganda* by CORTÉS-ALVAREZ, Yolanda, ESTRELLA-VELÁZQUEZ, Rafael, GONZALEZ-NERI, Aarón Iván and QUEZADA-MORENO, Maribel, with adscription in the Universidad Autónoma de Querétaro.

Content

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Model design to look for patterns related to suicide in social networks

Diseño de un modelo para buscar patrones relacionados con el suicidio en redes sociales

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Abstract

Many people with suicidal ideation use social forum platforms to post or discuss information about this complex topic. The key objective of our study is to design and evaluate a model to find patterns linguistically related to suicide. We address the detection of suicidal ideation through machine learning by applying it to the social network Twitter. To do this, we use different linguistic processors to obtain characteristics of each tweet and then catalog them using unsupervised classifiers. Finally, this information is used by 7 types of supervised learning (Naive Bayes, KNN, MLP, SVM, Decision Tree, Adaboost y Random Forest) and perform a comparative analysis of the classifiers using evaluation parameters, mainly accuracy. Our experiment shows 42 classification results, as well as sequential and parallel processing time data from the best-supervised machine learning, Random Forest.

Sentiment Analysis, Machine Learning, Suicide, Linguistic

Resumen

Muchas personas con ideación suicida usan plataformas de foros sociales para publicar o discutir información sobre este complejo tema. El objetivo clave de nuestro estudio es diseñar y evaluar un modelo para encontrar patrones que estén relacionados con el suicidio de forma lingüística. Abordamos la detección de ideación suicida a través de aprendizaje automático aplicándolo a la red social Twitter. Para tal fin empleamos diferentes procesadores lingüísticos para obtener características de cada tweet para después catalogarlos por medio de clasificadores no supervisados. Finalmente, esta información es utilizada por 7 tipos de aprendizajes supervisados (Naive Bayes, KNN, MLP, SVM, Árbol de decisión, Adaboost y Random Forest) y hacer un análisis comparativo de los clasificadores usando los parámetros de evaluación de rendimiento, principalmente exactitud. Nuestro experimento muestra 42 resultados de clasificaciones, además de datos de tiempo de procesamiento en forma secuencial y paralela del aprendizaje automático supervisado con mejor exactitud, Random Forest.

Análisis de Sentimiento, Aprendizaje Automático, Suicidio, Lingüístico

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1. Introduction

In Mexico, in 2020, a suicide rate of 6.2 per 100,000 inhabitants and 0.7% of the total number of deaths from this cause in the year was obtained, which constitutes 7,818 deaths due to self-inflicted injuries in the country. The suicide rate was also reported to be highest in the 18-29 age group, accounting for 10.7 deaths per 100,000 young people (INEGI, 2021).

The three states with the highest self-inflicted injury (suicide) deaths per 100,000 inhabitants are Chihuahua (14.0), Aguascalientes (11.1) and Yucatán (10.2). In Chihuahua, this rate has increased from 2017 (10.7) to 2020 to 3.3 per 100,000 inhabitants. Nowadays, according to the World Health Organization (WHO), every year about 800,000 people die by suicide, which is on average one person every 40 seconds (World Health Organization, 2021), representing an annual global age-standardised suicide rate of 11.4 per 100,000 inhabitants, 15.0 for men and 8.0 for women (O'Dea *et al*., 2015), also the WHO indicates that for every adult who died by suicide there may be approximately 20 people who attempted suicide (World Health Organization, 2021).

The results of the research by Bedoya Cardona *et al*. 2011 point to the assumption that suicide is more like the extreme manifestation of an unbearable psychological pain, rather than a psychotic disorder, and more an event propitiated by psycho-social factors than by genetic determinisms (Chávez Hernández *et al.*, 2011). This means that the determination of the suicidal act is more due to particular issues of the individual, rather than cultural elements.

There are risk factors in each person that may or may not be a direct cause of suicidal ideation, these factors are important characteristics that if the danger signs of suicidal action and the ways in which these clues are communicated between individuals are recognised in a timely manner, lives could be saved.

The present project is directly related to the prevention of this globally relevant social problem, death by suicide. Suicide is a complex issue for health professionals and is recognised by the WHO as a public health priority.

Many suicide deaths can be prevented (O'Dea *et al*., 2015) through timely, evidence-based and often low-cost interventions (World Health Organization, 2021), regardless of the victim's stage in the suicide process. Successful prevention relies on adequate suicide risk assessment (Desmet & Hoste, 2018) and understanding the ways in which individuals communicate suicide. This is one of the great difficulties we encounter, obtaining data that allow us to compose the situation that led a given person to end their life (Casado Blanco *et al*., 2012), as all the parameters of this risk have not yet been determined (O'Dea *et al*., 2015). While suicidal risk factors may or may not be a direct cause, they are important characteristics associated with suicide (Jashinsky *et al*., 2014) and if the danger signs of suicidal action and the ways in which these cues are communicated between individuals are recognised in a timely manner, lives could be saved (Birjali *et al*., 2017).

Automated tools and techniques are therefore required to monitor and help analyse the huge amounts of social media content that is generated every day, as most manual (human) controls are not feasible (Birjali *et al*., 2017). In 2016, suicide was the second leading cause of death in the 15-29 age group worldwide (World Health Organization, 2021). Furthermore, the most vulnerable population in terms of suicide deaths are young people and evidence suggests that young people are currently using social networks to transmit their suicidal thoughts or intentions (King *et al.*, 2018), in addition to the above, this is the most active sector of the population on social networks (Zafra Cremades *et al*., 2017), creating a perfect environment to detect thoughts through text generating the possibility of encountering cases of suicidal ideation.

As well as according to systematic reviews of studies on suicide and internet use among young people (Sueki, 2015), those with a history of self-harm or at high risk of suicide use the internet frequently. In conclusion, social media messages are in real time and in the course of a person's daily life making monitoring and detection to intervene in a suicidal action faster and more proactive.

Twitter is a free streaming social media site that allows registered users to communicate with others in real time through 140-character statements.

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The Twitter community is primarily made up of young adults. Twitter is used by 26% of Internet users aged 18-29 compared to 14% of 30-49 year olds and 9% of 50-64 year olds.

Twitter is of interest because of its greater public availability of data, larger user base and because it is a platform for personal expression. This large reservoir of information about people's daily lives and behaviours, if handled correctly, can be used to study suicide and possibly intervene.

A great advantage of this social network is that Twitter offers an application programming interface (API) that allows programmatic consumption of the data, making it an accessible data source for researchers. In addition, Twitter's streaming API provides a means to retrieve tweets as they occur, filtered by specific criteria, such as a list of keywords. While some tweets are marked as private, most are openly available to the public.

The structure of our article is as follows: Section 2 describes work related to suicide and suicidal ideation detected in social networks. Section 3 presents a proposed methodology divided into 5 stages corresponding to data collection, text processing, feature extraction, machine learning model generation and, finally, comparative analysis of linguistic processors. Section 4 examines the results of each linguistic processor and the most powerful machine learning techniques for the detection of suicidal ideation. In Section 5 and 6 we mention the acknowledgements and funding of the present project. In Section 7, we conclude our study and discuss the main limitations of our work. Finally, in Section 8 we present the bibliographical references used in our work.

2. Background

With the development of internet use, people have started to share their experiences and challenges (Tadesse *et al*., 2019) forming a new mode of communication (Cremades *et al*., 2017). This has increased the availability of content in the form of text (Esnaola *et al*., n.d.), creating the raw material needed to apply text mining techniques there and extract meaningful information.

Previous studies have collected and classified tweets related to suicide. De Choudhury *et al*. created a model that takes advantage of social activity, emotion and language cues manifested on Twitter, showing an index of depression that can be used to characterise levels of depression in populations (De Choudhury *et al*., 2013). As an additional method, Birjali *et al*. used a method for semantics with the WordNet database, where each term is associated with other terms. This database is a database of English words that are interconnected. If two words are close to each other, they are semantically similar. The method uses an algorithm that clusters words by their similarity, chooses root words from the densest clusters and uses semantic research to improve the performance of the system (Birjali *et al*., 2017).

The first study to use machine learning to predict the level of concern for suicide-related posts was done by O'Dea *et al*. where they used suicide-related keywords to collect tweets with the Twitter search API (O'Dea *et al*., 2015). A sample of the resulting dataset was manually labelled as very concerning, possibly concerning or safe to ignore. Machine learning models with cross-validation were found to perform as well as humans in distinguishing categories.

Desmet & Hoste differed from previous work in that they did not rely on keyword filtering for the high-bias problem of detecting suicidal messages in general user-generated content. Instead, they investigated a supervised text classification approach with a set of text features (Desmet & Hoste, 2013).

Jashinsky *et al*. also adopt a keyword-based approach to detect at-risk content on Twitter. Keywords were manually selected. The approach was validated by collecting geolocated tweets that matched the terms, comparing them to tweets from random users in the same US state. It was observed that states in the Midwest and Western US region and Alaska had a higher proportion of suicide-related tweeters than expected and similarly these states also have the highest actual suicide rates. This indicates that Twitter may be viable for large-scale monitoring of suicide risk factors (Jashinsky *et al*., 2014).

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3. Metodology

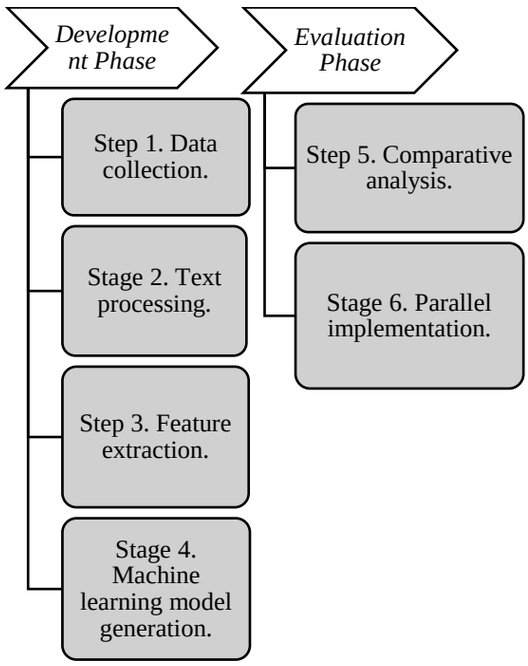

Figure 1 Methodology divided into two phases: development phase and evaluation phase
Source: Own Elaboration

The methodology is composed of two phases Development phase with 4 stages, and Evaluation phase with 2 stages. Figure 1 shows the methodology used in this work.

The development phase aims to collect data about suicide on Twitter, process and extract the characteristics of this data by means of the linguistic processors, in order to generate 7 machine learning models for each linguistic processor used. On the other hand, the evaluation phase aims to analyse and compare the accuracy results of the different Machine Learning models, in addition to the parallel execution of the model.

3.1. Stage 1. Data collection

As an initial step of the research, a review of multiple articles was conducted to identify possible keywords related to suicide based on various risk factors and warning signs linked to suicide. These risk factors and warning signs included depression and personality disorders such as schizophrenia and bipolar (Bedoya Cardona & Montaño Villalba, 2016), previous suicide attempts, family violence, family history of substance abuse, firearms in the home, and exposure to suicidal behaviour.

Other search terms included common antidepressants, as well as phrases indicating suicidality, ideation, deliberate self-harm, bullying and feelings of isolation, with the aim of building a database of the words identified.

An example of some of the vocabulary words referenced was research by Sueki, 2015, where he states that young internet users with a history of tweeting "want to commit suicide" were 2.0 times more likely to deliberately self-harm, 2.0 times more likely to have a suicide plan and 3.5 times more likely to have attempted suicide (Sueki, 2015). Also, in the work of Trotzek *et al*., they mention that exact phrases such as "my depression", "my anxiety", and "my therapist" and variations of the phrase "I was diagnosed with depression" are frequently used to detect psychological disorders in text (Trotzek *et al*., 2018).

Because non-English social networks are rather unexplored areas in computational linguistics (Tadesse *et al*., 2019), the created vocabulary was restricted to English words.

Once the referenced compilation of keywords is done, by means of Twitter's public API (application programming interface) computational tool, data acquisition of tweets is done using search term-based downloading to only compile tweets related to our suicide-related vocabulary. The use of the Twitter API tool requires the token and access keys obtained for the extraction of tweets in real time from the Twitter page.

The tweets were collected in a CSV database. It was estimated that a minimum of 2,000 tweets would need to be encoded to derive a data-driven model (Jashinsky *et al*., 2014) (O'Dea *et al*., 2015), so 200,000 tweets were stored in this research.

3.2. Stage 2. Text processing

Natural language processing combines a variety of techniques to parse and represent naturally occurring text at one or more levels of linguistic analysis for the purpose of achieving human-like language processing for a variety of tasks or applications, such as in social network messages. One tool used in the project and described in this section is sentiment analysis. Sentiment analysis is a process by which the emotional and sentimental spectrum contained in a sentence or word can be determined.

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For this purpose, there are different tools with extensive vocabularies for extracting these characteristics in a text. The processing of formal and grammatically well-written texts is a well-established area of research, the problem is that sentences are often not grammatically linked and not properly constructed.

An example of this is social media posts such as tweets. User-generated content often tends to deviate from the linguistic norm and tends to be more sparse than traditional content. Typical problems include misspellings, use of abbreviations, phonetic text and use of colloquial or ungrammatical language. Also, specifically for online messaging, they affect hashtags, emoticons, urls and mentions that may be used as part of the tweet message.

Next, using the NLTK (Natural Language Toolkit) and RE tools, which are modules containing many functions designed for use in the linguistic analysis of documents, the processing of the collected tweets was carried out, resulting in twelve text processing steps.

Starting with the RE tool, the text of the tweet was "cleaned" of data that did not add information for our approach. First the sequence of characters "http" and/or "https" plus the following combination of characters before any whitespace was removed, thus removing any URLs that are written in the processed tweet. The same was done with mentions and hashtags, removing the "@" and "#" character plus the following string of characters before any blank space. Next, all numbers and extraneous ASCII characters contained in the tweet were excluded, these being step four and five of the pre-processing.

Something important in English texts is the abbreviations typical of the language, such as can't, you'll, I've, where the words would be respectively can not, you will, I have. This information is often lost due to the different spelling and the same interpretation, and in the case of the negative "not" it is very significant when extracting the characteristics of the tweet, so it was decided to standardise the lengthening of tweets with abbreviations in order to avoid the loss of information.

As steps seven, eight and nine, punctuation marks were removed, this step is strictly after the lengthening of the abbreviations in English as otherwise the inverted commas would be removed and the function used would not detect any relation to the words. A single blank character (space) is normalised between each word, if there is more than one blank character it is removed until only one is left. Finally, it places the entire tweet in lowercase.

For the following processes, the NLTK tool was used, for which, as a next step, the text of the tweet is tokenised, to continue with the elimination of words known in computational linguistics as Stop-Words, which are words that do not add significant information by themselves, they are usually articles, prepositions, conjunctions, pronouns, etc. And performing a good text analysis for the elimination of these words or terms that are not useful is necessary in data mining to obtain better results.

In the research by De Choudhury *et al*. as well as Trotzek *et al*. it is mentioned that repetition of the word "I", past tense verbs, personal pronouns and possessive pronouns is a likely sign of depression (De Choudhury *et al*., 2013) (Trotzek *et al*., 2018).

The NLTK tool gives the freedom to add or remove words from this stop-word set, making the text processing adaptive, so "I" words, past tense verbs, personal pronouns and possessive pronouns were excluded from the default stop-word list and thus extracting more information from the text features.

Also, because the linguistic information is obtained from social networks and these have developed new ways of expressing certain words or phrases, an investigation of these linguistic forms was made to eliminate them in order to have a cleaner text.

As a last step, to avoid difficulties in the annotation of long texts, we discarded words that are longer than 18 letters and shorter than 1 letter, avoiding the word "I". These numbers of letters were normalised due to the average word length in the English language (Mayzner, 1965).

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3.3. Stage 3. Feature extraction

Sentiment analysis focuses on extracting features that can be opinions, affects and emotions within a wide range of different types of sparse and informal messages.

Several features can be used for classification, such as term presence, term frequency, negation, n-grams or the semantic value of words and tweets.

Lexicon-based approaches identify the presence of terms from a lexicon of known sentiment words. This is used in social media posts, given their strong connection to people's social environment, helps to understand people's social and psychological context.

At this stage, for each retrieved tweet, a feature vector was made for use with each machine learning method, resulting in a high-dimensional feature representation. These features were extracted from four different types of linguistic processors from which a sentiment or emotion analysis is obtained as appropriate.

Features representing feelings, affective and emotional features and levels of the terms used in the text were used to be incorporated due to the particularly emotive nature of the task. Linguistic processors such as TextBlob, NRC, Vader and LIWC were used for this. This helped to ensure that as large a set of explicit emotions as possible was covered.

TextBlob

TextBlob (Loria, 2020) is a Python library (2 and 3) for processing textual data. It provides a simple API for performing common natural language processing (NLP) tasks, such as part-of-speech tagging, noun phrase extraction, sentiment analysis, classification, translation and more.

TextBlob's polarity and subjectivity analysis was used. Polarity estimation by the term-matching method identifies the likely average polarity of words within text fragments based on the match with respect to a set of seed words of unambiguous and known sentiment polarity, represented by numbers from -1 to 1, where negative numbers represent a negative polarity and positive numbers a positive polarity, with 0 being a neutral polarity.

Desmet & Hoste confirm that negative polarity or lack of positive polarity is associated with suicide publications (Desmet & Hoste, 2013). Subjectivity has a range between 0 and 1, this represents a measure of sentiment with 0 being a very objective sentence and 1 being very subjective.

NRC

The NRC Emotion Lexicon (Mohammad, 2021) is one of the four sentiment dictionaries contained in the syuzhet library of the R programming language. This dictionary was developed by Saif M. Mohammad, a scientist at the National Research Council of Canada (NRC), and is available in more than 100 languages.

No. of terms	Categories	Associated score
14,182 words	Feelings: – Positive – Negative	– 0 – 1
~25,000	Excitement: – Anger – Fear – Anticipation – Confidence – Surprise – Sadness – Joy – Disgust	– Not associated – Weak – Moderate – Strongly associated

Table 1 Information from NRC terms
Source: Mohammad, 2021

The NRC library was divided into two categories: emotions and feelings. For emotions (NRC-E) it returns for each tweet the presence or absence of eight emotions: anger, fear, anticipation, confidence, surprise, sadness, joy and disgust; on the other hand, for sentiment (NRC-S) it shows how positive or negative the sentence of the tweet is. Table 1 shows the information of terms, categories, associated score and method of creation of the two forms of sentiment and emotion analysis.

The eight basic emotions are based on Plutchik's emotion wheel (Plutchik *et al*., 1990). Each primary emotion has a polar opposite, so that joy is the opposite of sadness, fear is the opposite of anger, anticipation is the opposite of surprise and disgust is the opposite of confidence. The uncoloured emotions on the emotion wheel represent an emotion that is a mixture of the 2 main emotions, e.g. anticipation and joy combine to be optimism.

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The vertical dimension of the cone represents intensity: emotions intensify as they move from the outside towards the centre of the wheel, which is also indicated by the colour: the darker the shade, the more intense the emotion. For example, anger at its lowest level of intensity is annoyance. Each word or token has a default value of 0 in the ten columns; if there is a value greater than 0, it means, first, that the term exists in the NRC dictionary and, second, that it has a value assigned for some emotion and/or feeling. In addition, NRC-S shows us what polarity the tweet has depending on the sign of the given data. Burnap *et al*. mention that emotions such as fear and anger are particularly prominent in suicidal communication (Burnap *et al*., 2017).

VADER

VADER, Valence Aware Dictionary and sEntiment Reasoner (Hutto & Gilbert, 2014), is a rule- and lexicon-based sentiment analysis tool that is specifically attuned to sentiments expressed in social networks and works well on texts from other domains.

VADER uses a combination of a sentiment lexicon, which is a list of lexical features that are generally labelled according to their semantic orientation as neutral, positive or negative, thus giving us three percentages of sentiment polarity neu=neutral, pos=positive and neg=negative. In addition, VADER offers a fourth column called compound=composite which is the sum of positive, negative and neutral scores that is then normalised between -1 (most extreme negative) and +1 (most extreme positive). The closer the composite score is to +1, the higher the positivity of the text. In the research of Trotzek *et al*. they found more negative feeling words in the depressed group (Trotzek *et al*., 2018).

LIWC

Finally, the language processor Linguistic Inquiry and Word Count (LIWC) (LIWC, 2021) was used. This tool functions as a reference measure with a set of words and a behavioural link, for this it contains a dictionary of terms annotated by psychologists in a number of relevant classes, including social relations, cognitive processes and expressions of affect, it also includes two features for positive and negative emotions and separate features indicating anxiety, anger or sadness.

The LIWC 2015 dictionary was implemented to measure all textual content submitted by users and extract linguistic features. This datalog includes: 21 standard linguistic dimensions (percentage of words in the text that are pronouns, articles, auxiliary verbs, etc.), 41 categories of words referring to psychological constructs (affect, cognition, biological processes, impulses, etc.), 6 categories of personal concerns (work, home, leisure activities, etc.), 5 informal language markers (nods, fillers, etc.) and 12 categories of punctuation (full stops, commas, etc.).

Burnap *et al*., 2017, use this text analysis software in their work given the psychological and emotional expressiveness of suicidal ideation (Burnap *et al*., 2017). Also the study by Tadesse *et al*., 2019 determined that taking into account the characteristics of LIWC and LDA, LIWC outperformed the thematic models generated by LDA (Tadesse *et al*., 2019).

3.4. Stage 4. Machine learning model generation

Next, to analyse the previously obtained features, classification approaches were employed for the collected tweets.

Machine learning is a subcategory of artificial intelligence, these are algorithms that focus on developing procedures that learn according to the data fed into the system.

At this stage, the use of algorithms for automatic detection using unsupervised and supervised learning was developed.

Unsupervised learning algorithms

Two types of unsupervised learning algorithms were used; K-means and PCA. The first one with the objective of separating tweets according to the similarities found by the algorithm in the features given by each of the linguistic processing tools, on the other hand, the second learning was used only for feature reduction.

The same classification parameters were used in all k-means classifications, which will be described below. In the initialisation method, "k-means ++" was used, which selects the initial cluster centres for each k-mean clustering, this clearly gives an acceleration of convergence.

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The number of times the k-means algorithm will be run each time the centroid changes is 10 times and the maximum number of iterations of the algorithm is 300 times, no random initialisation of centroids is used and the algorithm to use is "elkan" which, using the triangle inequality, according to scikit-learn.org, is more efficient on data with well-defined clusters. However, it consumes more memory due to the allocation of an additional array of shapes.

Tweet	Do not date someone anxiety you not good giving reassurance
TextBlob	2
NRC-S	2
NRC-E	2
Vader	2
LIWC	0

Table 2 Example of K-means classification
Source: Own Elaboration

It was standardised that, in each sentiment analysis tool, k-means would classify tweets into a group of three (K-means (n_clusters = 3)), whereby each tweet has five categorisations being either 1, 2 or 3.

The high dimensionality of the feature space associated with each tweet can lead to overfitting of the training data; therefore, the most effective way to reduce the dimensions is to implement the feature extraction technique Principal Component Analysis (PCA).

Therefore, PCA was applied as a dimension reduction procedure to convert the set of all possibly correlated variables into a new set of linearly uncorrelated features called principal components.

This reduction algorithm was only used with the LIWC language processor, as it had 92 features and the features provided by LIWC were reduced to 3 principal components. Example in Table 3.

Tweet	Do not date someone anxiety you not good giving reassurance
PCA1_LIWC	-2.504381
PCA2_LIWC	-0.63567545
PCA3_LIWC	3.05660069

Table 3 Example of feature reduction by PCA
Source: Own Elaboration

The default PCA solver was used, which selects if the input data is larger than 500x500 and the number of components to extract is less than 80% of the smallest dimension of the data, then the more efficient 'random' procedure (by the method of Halko *et al*.) is enabled. Otherwise, the 'full' method (LAPACK solver) is enabled and subsequently truncated. The cumulative variance for a 3 principal component reduction was 19.78%.

Supervised learning algorithms

Supervised learning methods are performed by studying the features that tweets are likely to possess. Seven types of supervised learning were used: decision tree (DT), adaboost (AB), Naive bayes (NB), k-nearest neighbors (KNN), multilayer perceptron (MLP), Random Forest (RFC) and support-vector machines (SVM); the last two are ensemble supervised learning algorithms.

	TextBlob	NRC-S	NRC-E
DT	100.00%	99.99%	99.93%
AB	100.00%	100.00%	99.90%
NB	99.00%	98.00%	94.00%
KNN	100.00%	99.99%	99.71%
MLP	100.00%	99.95%	99.99%
RFC	100.00%	99.99%	99.92%
SVM	100.00%	99.95%	99.93%
	Vader	**LIWC**	**LIWC (PCA)**
DT	99.89%	99.31%	85.13%
AB	99.90%	99.22%	84.93%
NB	94.00%	92.00%	75.00%
KNN	99.86%	99.02%	74.90%
MLP	99.97%	99.78%	80.41%
RFC	99.93%	99.11%	88.01%
SVM	99.72%	99.97%	75.45%

Table 4 Accuracy results for each supervised learning algorithm
Source: Own Elaboration

For each set of features given by the linguistic processors and their grouping by unsupervised learning, classification was carried out with each of the types of supervised learning used. In total there were 42 classification results.

Each of the classifications was coded with the default Scikit-learn parameters. It was standardised that in the event that any rating score was very poor, less than 70%, the rating parameters would be modified, but this was not the case for any of the 42 results.

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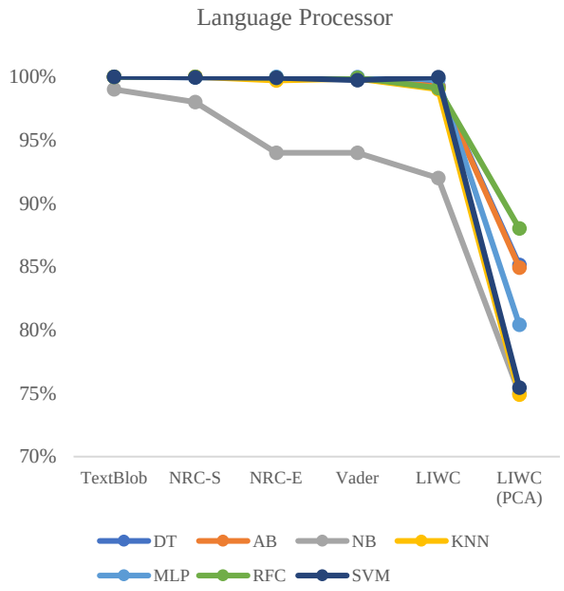
3.5. Stage 5. Comparative analysis

In the last stage of the methodology, stage 5, the total accuracy terms were examined for each of the categories, in total 42, with 4 types of linguistic processors being used, but by splitting NRC into sentiment NRC and emotion NRC, and decreasing the LIWC features with PCA, there were 6 sets of features that went into 7 types of supervised learning algorithms. The accuracy results of the 42 classifications of supervised learning algorithms are shown in Table 4 below.

4. Results

Graphic 1 shows the relationship between the linguistic processors and their accuracy parameters of each supervised learning algorithm.



Graphic 1 Relationship between TextBlob, NRC-S, NRC-E, Vader, LIWC and LIWC language processors with PCA, and accuracy parameters given by 7 supervised learning algorithms
Source: Own Elaboration

N°	Language Processor	Accuracy
1st	TextBlob	99.86%
2nd	NRC-S	99.70%
3rd	NRC-E	99.05%
4th	Vader	99.04%
5th	LIWC	98.34%
6th	LIWC (PCA)	80.55%

Table 5 Average accuracy per language processor
Source: Own Elaboration

Table 5 and Table 6 show the averages in descending order of the results in the accuracy parameter for each language processor and supervised learning algorithm used respectively. We can notice that most of the linguistic processors obtained a very good response, mostly approaching 100%. The linguistic processor with the highest accuracy was TextBlob with 99.86% and with the lowest accuracy was LIWC with feature reduction with PCA with 80.55%. The supervised learning algorithm with the highest accuracy was Random Forest (RFC) with 97.83% and with the lowest accuracy was Naive Bayes (NB) with 92%.

N°	Supervised learning	Accuracy
1st	RFC	97.83%
2nd	DT	97.37%
3rd	AB	97.32%
4th	MLP	96.68%
5th	SVM	95.84%
6th	KNN	95.58%
7th	NB	92.00%

Table 6 Average accuracy per supervised learning algorithm
Source: Own Elaboration

4.1 Stage 6. Parallel implementation

Although all the accuracy results of each supervised learning were on average very good, the learning with the closest to 100% was chosen for parallel processing, Random Forest with a score of 97.83%.

Within the optimisation of machine learning processes is parallel processing, which is designed to run on a multiprocessor system and its main purpose in parallelising an algorithm is to reduce processing time by distributing tasks among the available processors. In order to optimise the system, a parallel program was used within the same classification by means of an attribute of the scikit learn library, which is "n_jobs". This attribute within each supervised learning classification function is in charge of executing the processes in parallel. Depending on the number to which the attribute is equalised is the number of jobs that will be done in parallel, if "-1" is set it means that all processors will be used. This attribute is set by defalult to 1 job at a time. This optimisation was performed with 8 parallel processes at the time of classification with supervised learning.

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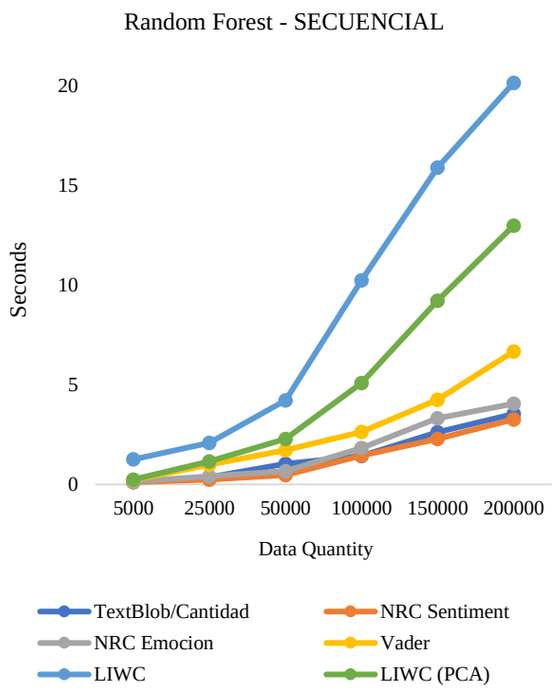
Linguistic tool	5000 data	25000 data	50000 data
TextBlob	0.124	0.365	1.030
NRC-S	0.113	0.236	0.472
NRC-E	0.137	0.406	0.670
Vader	0.223	0.982	1.726
LIWC	1.257	2.093	4.221
LIWC (PCA)	0.246	1.149	2.281
Linguistic tool	**100000 data**	**150000 data**	**200000 data**
TextBlob	1.435	2.613	3.538
NRC-S	1.438	2.280	3.264
NRC-E	1.830	3.328	4.053
Vader	2.631	4.250	6.677
LIWC	10.254	15.909	20.167
LIWC (PCA)	5.094	9.231	12.994

Table 7 Time (seconds) of processing with Random Forest in a SEQUENTIAL way
Source: Own Elaboration

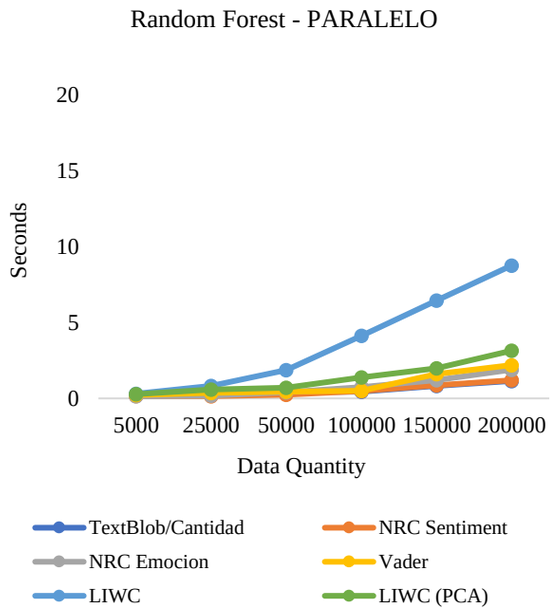
Linguistic tool	5000 data	25000 data	50000 data
TextBlob	0.179	0.205	0.408
NRC-S	0.164	0.152	0.244
NRC-E	0.146	0.192	0.397
Vader	0.223	0.369	0.438
LIWC	0.307	0.825	1.869
LIWC (PCA)	0.276	0.586	0.706
Linguistic tool	**100000 data**	**150000 data**	**200000 data**
TextBlob	0.436	0.826	1.146
NRC-S	0.491	0.856	1.197
NRC-E	0.740	1.196	1.889
Vader	0.503	1.606	2.192
LIWC	4.124	6.448	8.749
LIWC (PCA)	1.388	1.985	3.141

Table 8 Time (seconds) of processing with Random Forest in PARALLEL form
Source: Own Elaboration

The results in seconds of the classification using Random Forest are shown in Table 7 and Graphic 2. The amounts of time in seconds are shown for each of the 5 linguistic tools plus LIWC reduced by PCA, and the time was counted with different amounts of data: 5,000, 25,000, 50,000, 100,000, 150,000 and 200,000. Table 7 and Graphic 3 show the results for sequential processing and Table 8 and Figure 4 for parallel processing.



Graphic 2 Result Random Forest SEQUENTIAL
Source: Own Elaboration



Graphic 3 Result Random Forest PARALLEL
Source: Own Elaboration

The reduction in computation time obtained when using parallel programming showed a significant difference with respect to the execution of the simple algorithm. The language tool with the largest decrease in time with the largest amount of data was LIWC (PCA) with approximately 414%. Graphic 5 shows the percentage decreases.

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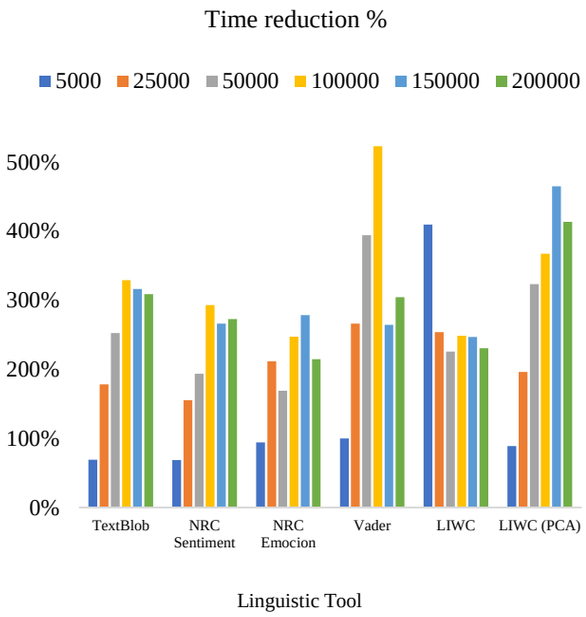

Graphic 5 Percentage decrease in time
Source: Own Elaboration

5. Acknowledgement

I thank the Consejo Nacional de Ciencia y Tecnología (CONACYT) and the Instituto Tecnológico de Aguascalientes for their support and sponsorship of this research.

6. Conclusions

Suicide is a global health problem that has increased in recent years, and it has been shown that artificial intelligence systems, more specifically machine learning, can help identify suicidal ideation and could surpass mental health professionals in detection.

The present work was based on these assertions. A vocabulary related to suicidal intent and ideation was used to collect texts from the social network Twitter and it was observed that, when the tweets were treated with NLTK and RE tools from 12 steps of text preprocessing, their features could be successfully extracted from 4 linguistic processors (TextBlob, NRC, Vader, LIWC), splitting into two NRCs as NRC-S for sentiment and NRC-E for emotions and adding a sixth one as LIWC with feature reduction from PCA. These features were clustered with K-means, in order to use 7 types of supervised learning algorithms; decision tree (DT), adaboost (AB), naive bayes (NB), k-nearest neighbors (KNN), multilayer perceptron (MLP), random Forest (RFC) and support-vector machines (SVM), and to analyze and compare their results on the overall accuracy parameter.

The accuracy was on average very good, being more accurate with the TextBlob linguistic processor with a score of 99.86% and with the Random Forest supervised learning algorithm with 97.83%.

This classifier was optimised by parallelising the method, in this case there were 8 processes where the biggest time reduction was in the classification where the LIWC linguistic processor was used with the features reduced with PCA from 12.994 seconds to 3.141 seconds, which in percentage was a time reduction of 414%. Furthermore, the shortest classification time was with the Textblob linguistic processor with a parallel time of 1.146 seconds.

It can therefore be concluded that the best method of detecting suicidal ideation by means of the social network tweet is random forest, being the best option for LIWC feature extraction with PCA, in terms of processing time and accuracy.

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Tools to enable communication between sensor devices

Herramientas para habilitar la comunicación entre dispositivos sensores

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Abstract

This paper describes an analysis of applications to enable communication between systems such as: telemetry and sensors that interact in the RICB (Rescue In Collapsed Building) system that searches for victims in buildings collapsed by earthquakes, in which a decentralized communication platform is required. This platform needs to work independently from Internet such that people can integrate themselves with their devices such as: smartphones, tablets, laptops, and other mobile devices. An independent Internet collaboration tool is required, without a license, for which several were investigated, and an analysis and comparison of characteristics is presented. Tests showing which best adapts to the RICB system, chooses the one that is most flexible and versatile, especially when communicating between several different elements such as: people, applications, and sensor devices. For this investigation exhaustive research of applications was carried out; later their characteristics were tested, eliminating those that did not match the needs of the RICB system, resulting in two tools that were installed and tested. The contribution of this article is the search and choice of applications that maintain the connection between devices despite the lack of Internet.

Comparison, Systems, Analysis, Sensors, Telemetry

Resumen

Este artículo describe un análisis de aplicaciones para habilitar la comunicación entre dispositivos tales como telemetría y sensores que interactúan en el sistema RICB (Rescue in Collapsed Building) que busca victimas en edificios colapsados por sismos, en la cual se requiere una Plataforma de comunicación descentralizada. Esta plataforma debe funcionar temporalmente independiente de Internet para que las personas que interactúan puedan integrarse con sus dispositivos móviles como teléfonos inteligentes, tabletas y computadoras portátiles. Se requiere de una herramienta de colaboración independiente del Internet, sin licencia, para lo cual se investigaron varias, se presenta un análisis y comparación de características. Las pruebas muestran la que mejor se adapta al sistema RICB, eligiendo la que es más flexible y versátil especialmente cuando la comunicación viene entre varios elementos distintos tales como: personas, aplicaciones y dispositivos sensores. Para la investigación se realizó una búsqueda exhaustiva de aplicaciones, posteriormente se probaron sus características, eliminándose aquellas que no cumplieron con las necesidades del sistema RICB teniendo como resultado +dos herramientas que fueron instaladas y probadas. La aportación de este artículo es la búsqueda y elección de aplicaciones que permiten mantener la conexión entre dispositivos pese a la falta de Internet.

Comparación, Sistemas, Análisis, Sensores, Telemetría

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Introduction

A fundamental challenge in connection with human behavior in catastrophic situations is the image that the general perception of this topic has been shaped by decades of disaster films (Akhgar and Waddington 2017). In those films, the reactions of the civilian population to catastrophes are usually described as panic, shocked, passive, or paralyzed, with the aim of making the protagonists stand out through their readiness to act (Akhgar and Waddington 2017). However, this perspective does not correspond to reality, and leads to a fundamental misunderstanding among the population (McSeveny and Waddington 2017):

1. First of all, there is the myth of mass panic, which propagates those emotions such as: exaggerated, contagious and irrational fears, which inevitably overtake people in such an exceptional situation, lead to hasty and ill-considered flight behavior, which is not restricted by any social rules or conventions.

2. Another widespread, but equally false assumption, is the helplessness of people. That they react in a stunned or frozen manner and accordingly can no longer guarantee their safety and well-being in an appropriate manner.

3. The third and final falsified myth is the inevitable civil unrest that results from the idea that emergencies provide a context or excuse for people to behave antisocially or opportunistically (for example, through general rioting or looting).

Positively speaking: People in collective states of emergency generally act socially, rationally, and actively. (Smarter 2020). Therefore, communication and collaboration in crisis situations are considered as a special case, but still a case of everyday collaboration tasks. And thus, strives for the use of standard tools with the mere restriction of temporary non-availability or only little availability of resources like Internet and electricity access.

Development

The RICB (Cuevas-Rasgado et. al. 2022) is programed in a Raspberry pi zero, with a movement sensor, temperature and GPS Neo-6m connection. This Raspberry is inside a small transparent sphere made of resistant material to enter collapsed buildings. This entry is in accord with the strategy of rescuing people, mainly in places where the rescue squad suppose there are victims. Figure 1 shows the general diagram of RICB.

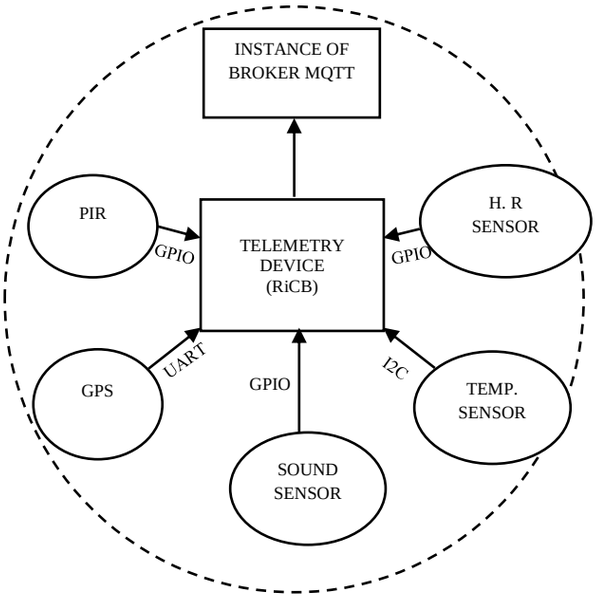

Figure 1 General diagram of RICB that describes the protocols of the sensors

Tools to enable communication among the RICB sensor devices

There are interesting works related to RICB, such as (Tumbaco 2022) that uses the MQTT protocol in the interaction of messages given by sensors in a security system, although in (Berbes et. al. 2022) an Application Programming Interface (API) that uses the FIWARE platform and the standards, generic components and Rest API services are presented. The plataforms's services are to facilitate the development of custom Internet of Things (IoT) applications. Others works such as (Cardona 2022) focus on people with hearing difficulties and provide better communication by translating some signs or voice into plain, natural text without excessively harming immersion, all through use of Virtual Reality (VR). With this technology, tools have been created that help any user with hearing problems to communicate naturally.

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For this Meta Quest is required to recognize the real hands of the user and project them in a VR; it also incorporates microphones and speakers. These works are all interesting due to the interactivity that exists between its components. However, all of them require an Internet connection. To manage the process of searching for live victims, and to enable communication among the RICB sensor devices, the Artificial Intelligence, and local rescue teams, a decentralized communication platform is required. That platform needs to work independently from Internet such that acting people can integrate themselves with their smartphones, and other mobile devices such as tablets and laptops.

Even though some of the market leaders such as Slack or Microsoft Teams offer a vast set of useful features for collaboration (Oracle 2020) these suffer decisive disadvantages. These products need permanent Internet access, and they need to be licensed. Here public domain software products seem to be more useful: They can be run on ad hoc networks, for example established on simple laptops serving as locally available access points. Furthermore, these access points can be set up independently using Docker images or images of a virtual machine (VirtualBox (Oracle 2020)) that can be distributed on storage devices such as memory sticks together with the RICB sensor devices.

Team collaboration tools

To obtain a license-free, Internet independent collaboration tool two publicly available tools were investigated. These were Mattermost (Mattermost 2020) and Matrix (Matrix 2020).

Mattermost

Mattermost is a communication service that enables direct communication between two or more actors in a direct communication space, as well as communication of several participants in corresponding "rooms". A room is a large team chat, which is dedicated to a defined topic or category and further subspaces can be contained here. A topic or category can be a group, for example, such as a rescue team, a common task, or a common interest.

Mattermost clients can be installed on all common operating systems, such as Android, Linux, IOS, and Windows. Alternatively, to the Mattermost proprietary client one can access Mattermost with any standard Internet browser and the appearance of the client does not change much.

Matrix and element app

Matrix is an open standard for decentralized, secure real-time communication over IP (Matrix Network 2020). The project is open source and maintained by the non-profit Matrix foundation. It is built to interoperate with other communication systems such as email, WhatsApp, Telegram or even IOT-devices. The standard is based on JSON and HTTP or HTTPS for data transmission and communication. In fact, any device that speaks HTTP can communicate via Matrix.

Matrix is designed from the ground up for decentralized operation. Each message that is sent in a chat room is synchronized to all other servers that participate in that room. If one server collapsed, all the other users in the room can still use the service and continue with their communication. When the server comes back online, the messages are synchronized again, and pending messages are transmitted. In contrast to the other group chat tools, the decentralized approach is therefore much more deeply anchored in the system.

The Element App (Element 2020) (formerly Riot.IM) is a client using the Matrix standard for communication. It offers features such as: chat rooms with thousands of users, file sharing, voice, and video calls, and all the other known features from group chat tools. Apps for iOS, Android, Webapp and desktop clients are available as well. The developers have used Matrix already to integrate a drone, control its flight and stream the image of its camera with a video call into an Element App chatroom.

The French government announced in April 2018 that it would introduce Matrix and Riot.IM as a strategic communication platform for its ministries and officials (Yates 2019). Since then, approximately 50% of the ministries have migrated to Matrix and Element App. This has given an enormous boost to the Matrix project. The existence and further development of the Matrix project seems to be more than secured with such an important customer.

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Comparison of Mattermost and Matrix

In order to compare the two tools their project-relevant features were determined and then the availability of these was checked. See Table 1.

Feature	Mattermost	Matrix (Riot)
Groups/Rooms	Yes	Yes
Send read markers	No	Yes
Sendings invites	No	Yes
Reply in threads	No	Yes
Attachments	Yes	Yes
Formatted messages	Yes	Yes
New user registration	No	Yes
Multiple accounts	No	Yes
Plugins	Yes	Yes
Intelligent notifications (e.g. if user is mentioned in message)	No	Yes
Bridge to other messengers	Yes	Yes
End to end encryption	Yes	Yes
Keyword notifications	Yes	No
Advanced permission controls	Yes	Yes
Server can be used in container	Yes	Yes
Already existent docker file for server	Yes	Yes
Large variety of messenger and servers based on original version	No	Yes
Easy to modify messenger and server applications	No	Yes

Table 1 Feature comparison

Here Matrix shows better suitability for the rescue process, especially due to the easy registration of new users, the large variety of supported clients, third party messenger apps, and server architectures. Also, the API of Matrix proved more open than Mattermost's. Therefore Matrix was favored as collaboration tool.

Rollout of collaboration tools

Matrix

Two variants were tested. Rollout via Docker (Docker 2020) or via a VirtualBox (Oracle 2020) Ubuntu-image. The latter variant proved to be easier to be rolled out, especially when it comes to installing several servers running in parallel. In our case, besides the Matrix/Synapse server an OpenStreetMap server for offline map services and an Apk server for the client's rollout is needed.

Matrix Clients

Depending on the rescue teams' needs Matrix clients described in (Matrix Client 2020) were investigated: The Element App and Pattle.

Element app

The Element App is available as web and various mobile versions. It integrates most of the features available through the Matrix SDK – the mobile version is nearly the same as the desktop version, but text formatting editor and multiple accounts feature are omitted. Both offer a few integrated plugins, among these Jitsi for video and telephone conferences, a plugin for shared use of documents and tables, and a Google Calendar plugin for sharing events. Furthermore, different possibilities to integrate bots are offered, what opens an easy way to bridge external sensor devices and KI algorithms' results. It has an easy usable User Interface (UI) in most parts of the Element App. It is available on Google Play Store and the App Store.

Pattle

Pattle offers a very simple and clear UI but only supports text messaging and photo attachments. There are no plugins and no formatting available.

It is available on the Google Play Store and on TestFlight for public iOS Beta Testing.

As a result of this comparison, the Element App for mobile usage was applied. Both (Element App and Pattle) can be used in parallel but only Element App supports all the features needed (plugins, formatting, joining groups). The Element App is also the official service of the Matrix foundation that is the main contributor to the Matrix service. Because of this, it is the most promising for a long support and lifetime. See Figure 2.

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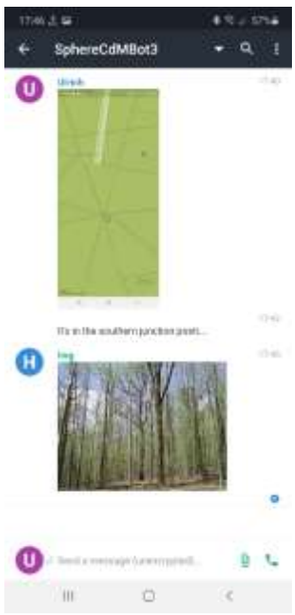

Figure 2 Test Use Case (UC) in Smartphone using the element App

Openstreetmap (OSM) integration

OpenStreetMap (OpenStreetMap 2020) was used in the past, and is still used for many humanitarian projects, in the case of natural disasters and epidemics. As a result, there are many different parallel developments of projects with OpenStreetMap in this context. During our research work many examples were found, but most of them were isolated solutions that addressed a specific problem and were inadequate elsewhere. By researching the working practices and reports of humanitarian projects that have used OSM in the past, it was eventually decided for POSM (American Red Cross 2020) since POSM allows bringing the standard toolset along for the ride when there isn't access to cheap and fast Internet connectivity.

For the sake of simplicity, the POSM server was integrated into the VirtualBox server image used for Matrix and Apk delivery too.

Conclusion and future works

The Element App has proven very flexible and versatile for most UCs especially when it comes to communication among many different parties (rescue teams, bots, and artificial intelligence). Moreover, its effectiveness and efficiency may be enhanced somewhat by dedicated apps for the most common UCs. Hence, currently the following UCs are designed, and the designs are tested for their usability:

UC1 and UC2: Onboarding, creating a helper profile, see Figure 3.

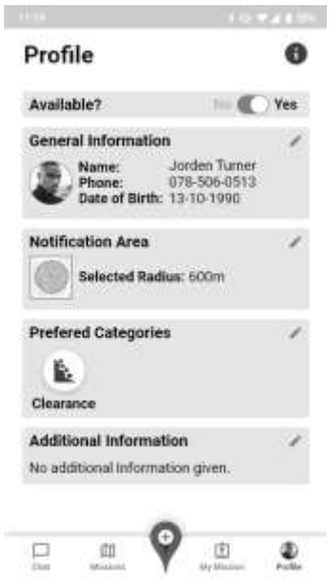

Figure 3 UC2 Design of Helper Profile Entry

UC3: Receiving and accepting a personalized call for help.

UC4: Selection of a call for help on a map.

UC5: (As a central manager, bot, or AI) send a call for help (See Figure 4).

UC6: Processing and completing a call for help.

Figure 4 UC5 Design of Mission Creation

Acknowledgements

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A didactic tool for updating the teaching-learning process of English as a foreign language

Una herramienta didáctica para actualizar el proceso de enseñanza-aprendizaje del Inglés como lengua extranjera

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Abstract

The teaching-learning process is a binomial in constant change due to its actors and contexts. Therefore, this process requires an update to respond to students' needs according to their learning styles. Given this situation, the objective of this study is to know if TikTok, as a didactic tool, can contribute to said educational update and develop oral skills since it centers on communicative competence. Regarding the methodology, the descriptive quantitative approach took place on a 50-student sample enrolled in an extracurricular course. The findings provide contributions of a theoretical nature since they characterize TikTok as a didactic tool to update the English teaching-learning process with an innovative, participatory, and collaborative methodology with motivational features and ubiquitous learning. Besides, it contributes to oral skills development through the construction of knowledge, interpersonal relationships, discursive and sociocultural skills development, and the promotion of positive attitudes towards work (commitment).

Competence, Didactic, Ubiquitous

Resumen

El proceso de enseñanza aprendizaje es un binomio en constante cambio debido a sus actores y contextos. Por tanto, dicho proceso requiere de una actualización para dar respuesta a las necesidades de los estudiantes acorde a sus estilos de aprendizaje. Ante esta situación, el objetivo de este estudio es conocer si Tiktok como herramienta didáctica puede contribuir a dicha actualización educativa y desarrollar la habilidad oral al ser una herramienta basada en la competencia comunicativa. Por lo que respecta a la metodología, se recurrió al enfoque cuantitativo descriptivo en una muestra de 50 estudiantes registrados en un curso extracurricular. Los hallazgos aportan contribuciones de tipo teórico dado que caracterizan a TikTok como una herramienta didáctica para actualizar el proceso de enseñanza aprendizaje del inglés con una metodología innovadora, participativa y colaborativa con tintes motivacionales y aprendizaje ubicuo. Por otra parte, aporta al desarrollo de la habilidad oral a través de la construcción de conocimientos, relaciones interpersonales, desarrollo de habilidades con competencias discursiva, socioculturales y fomento de actitudes positivas hacia el trabajo (compromiso).

Competencia, Didáctica, Ubicuo

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Introduction

Information and Communication Technologies (ICT) are currently an essential tool in schools due to new educational modalities (Palomo *et al*., 2005), which implies skill development because of their frequent techno-pedagogical application. This fact has triggered urgent training for the appropriate use of such technology when managing information, empowerment, and learning knowledge.

However, the learning and knowledge technologies in language teaching are not enough as a consequence of various elements such as adequate training for technology-mediated teaching, lack of equipment or resources for the educational process, absence of close links between the theory and practice, and training and information on ICT-based educational tools. Given this situation, the requirement for establishing a contextualized and self-regulated praxis according to pupils' needs is evident. That is why social networks are considered a tool with a didactic perspective for updating and innovating the teaching-learning process and skills in a foreign language (García and Cabrera, 2022).

Besides, Hernández (2021) indicates their usefulness in the educational field to influence social behavior, communication, entertainment, cultural exchange (Simmel in Breiger, 2000), and direct interaction between students and student-teacher (Flores *et al*., 2021). In addition, their use in language teaching responds to the natural and current needs of a technological society that demands knowledge or communication skills (Chiunti, 2021) to join social and work life. They also provide advantages to teachers, specifically to current and dynamic training (Cuq, 2003) for praxis to promote contact between students different from traditional classrooms through virtual interactions. Social networks allow students and teachers to practice the language in context.

However, its implementation needs a specific profile based on skills to promote synthesis, spelling, writing, and the expression of ideas, as well as strategies to organize (Montealegre, 2016) the content according to objectives.

In this regard, the Benemerita Universidad Autonoma de Puebla (BUAP), in 2009, incorporated a Model called Modelo Universitario Minerva (MUM), where the teaching-learning process seeks the development of communication skills: linguistic, sociolinguistic, pragmatic, and intercultural, and above all, know-how to do through the use of information and communication technologies (ICT) (Modelo Universitario Minerva, 2007). Nonetheless, given the prevailing educational reality due to the post-pandemic, in the Faculty of Languages from BUAP, there is a need to implement innovative tools that contribute to the virtual or hybrid teaching-learning process, enabling an autonomous, self-managed and dynamic task to update the educational process. Based on this reality, the objective is to know if TikTok allows updating the English teaching-learning process and what oral skill components this social network develops as a didactic tool. The hypothesis that guides the research is: The TikTok social network used to learn English as a foreign language enables the updating of the teaching-learning process and the oral skill development.

Literature review

On September 27th, 2011, UNESCO established a workshop on the free flow of information and social networks: their role in democracy and social participation as part of the sixth meeting of the Forum on Internet Governance (IGF) held in Nairobi, Kenya, where was stated that "social networks catalyze civic and democratic participation [...]" (UNESCO, 2011, p. 62). That is, networks contribute to personal, direct, formal, and instrumental social ties between individuals who share values and beliefs (Tönnies and Harris, 2001).

Social networks

The term social network, invented by British anthropologists John Barnes and Elizabeth Bott in 1954, is external links of belonging to a family, residential, or social group to be essential. The objectives that led to the creation of the so-called social networks are different, for instance, the design of virtual interaction where millions of people concentrate on their interests. Sites promoting friends' online networks began to appear in 2002 to describe relationships within virtual communities and, in 2003, became popular with MySpace.

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Currently, there are more social networks such as Facebook, Twitter, Identi.ca, Mupiz, Viadeo, Instagram, LinkedIn, Pheed, and TikTok. In those communities, there are features such as up-to-date profiles, access to address books, the creation of new links with referral services, and other forms of online social networking. That is why Internet Social Networks continue to grow swiftly, especially in Web 2.0 and Web 3.0. In addition, social media encompasses various activities that integrate technology, social interaction (between individuals or groups), and content creation. Andreas and Haenlein (2010) also point out that the purpose of social networks is to design and socialize digital content with collective intelligence in online collaboration.

Through these social media, individuals or groups collaborate to create all Web content, organize the content, index, modify or comment, combining it with personal creations. In this regard, social media uses techniques such as RSS and other Web syndication streams, blogs, wikis, photo sharing (Flickr), video sharing (YouTube), podcasts, social networks, the collaboration of bookmarks, mashups, virtual worlds, and Microblogs, which along with learning and knowledge technologies make these sites a potential tool in the educational field. Indeed, social network theory is a very active field, and various searchable social network analysis tools are available online, being relatively easy to use by simply presenting a graph of the social network. In this way, the diffusion of innovation theory explores social networks and their role in influencing the practices of new ideas.

Technology and Education

Today, technology has permeated the educational field, turning it into a more dynamic model through audiovisual and material supports with extensive coverage, through platforms that promote education without limits in time and space with synchronous and asynchronous interactions, thanks to multiple digital tools and social networks.

These new virtual educational environments promote instant communication despite the distance among their actors and the development of collaborative work (Alonso and Alonso, 2014), a fundamental axis in education.

In addition, Abuín (2009) refers that social networks encourage communication and autonomous learning in students, especially in a foreign language, since such networks allow participation and exchange of information in a motivational environment (Garrigós *et al*., 2010).

Moreover, different findings prove that the didactic procedures based on ICT and social networks stimulate interest and motivation compared with traditional methodologies because the former leads to natural learning for sharing content and creating discussion sites (Espuny *et al*., 2011).

Nevertheless, with these new elements in education, teachers need to keep up with this innovation to be part of the change. Therefore, they require an update to apply these social networks or digital tools in their teaching work for their students.

TikTok

After the digitization of teaching, social network usage as audiovisual material has increased exponentially during the pandemic and post-pandemic period as TikTok, which its mission is to "capture and present creativity, knowledge, and life's most valuable moments directly from the mobile phone" (Mohsin, 2021, para.6).

This application, with 885 million users (Kemp, 2022), mixes non-verbal language and music that become pedagogical elements to trigger motivation and authors' originality (Escamilla-Fajardo *et al*., 2021).

Due to the above, it develops communicative competence and oral production in a foreign language, guiding students to place theoretical knowledge into practice and privileging experiential learning (Tobeña, 2020) rather than a traditional and passive one. Furthermore, users find advantages in the social network as millennials (Landa and Ramírez, 2018) with digital skills to transmit content rather than receive it.

Despite that, the results obtained concerning their possible impact on the learning process are still quantifiable (Hew and Lo, 2020), where most of the research affects the higher level (Fernández-Díaz *et al*., 2017).

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Also, teachers as digital migrants must be prepared to work with the new technological trends and include them in their educational work to update their praxis and satisfy the student's needs. In this point, TikTok is an autonomous and meaningful learning strategy to achieve content and objectives (Orellana, 2017).

Some of its characteristics are the following:

1. Encourage creativity. With the challenge and hashtag functions, students become familiar with the syllabus and are encouraged to learn. 2. Develop non-verbal language. Gesticulation or body expression are essential complements in the communication process, favored with TikTok with the creation of audiovisual-content videos from 3 to 60 seconds, including effects, music, or filters for meaningful long-term learning.

2. Contribute to the sense of belonging. The social network develops a sense of belonging to a group where different activities are carried out through interactions, providing feedback with comments, and collaborative work.

3. Adapt to the educational field. Digital applications offer an augmented reality that goes beyond the ludic, reaching academic purposes.

4. Engage students in the learning process. Thanks to the artificial intelligence incorporated into this social network, capturing attention by showing them trending topics to comment on and avoiding offensive conversations through the comment filter is easy.

5. Promote proper time usage. The healthy use function regulates users' handling time.

Methodology

Based on the purpose of the study, the research is quantitative with a descriptive scope to characterize the subjects' perceptions towards Tiktok.

Sample

The research context is the English Teaching Bachelor at the Benemerita Universidad Autonoma de Puebla, and the total population is the sample made of 50 students enrolled in an extracurricular course during the spring of 2022, who share the following characteristics: 25 men and 25 women, aged between 19 and 28 years old, level B1 and poor proficiency in oral and written skills.

Moreover, the participants state in an interview that such a problem is a consequence of inadequate techno-pedagogical materials or courses according to their previous knowledge and learning styles. From this situation, it is crucial to know if Tiktok can update the English process and nurture the improvement of these skills.

Instrument

It is a 20-item questionnaire with a 5-interval Likert-type scale (Hernández *et al*., 2010) to measure subjects' reactions. Those items are grouped into two sections to verify the plausibility of TikTok as a tool for updating the English teaching-learning process and identifying which skills it promotes in the extracurricular course. It is worth mentioning that the instrument was validated with the SPSS software, obtaining .92 reliability.

Data collection

The online instrument was applied to collect data and quantify the attributes of TikTok for updating the teaching-learning process and skills development. For this, the researcher informed that said instrument was part of a project without altering the context or providing information that could cause bias.

Model analysis

It is aligned with the study variables as follows:

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Variables

	Variable	Purpose
RQ1.	TikTok to update the English teaching-learning process	Identify the plausibility of TikTok implementation as an updating tool in the English teaching-learning process
RQ2.	The oral skill features the social network promotes	Know what components of the speaking skills TikTok encourages

Table 1 Model analysis
Own Elaboration.

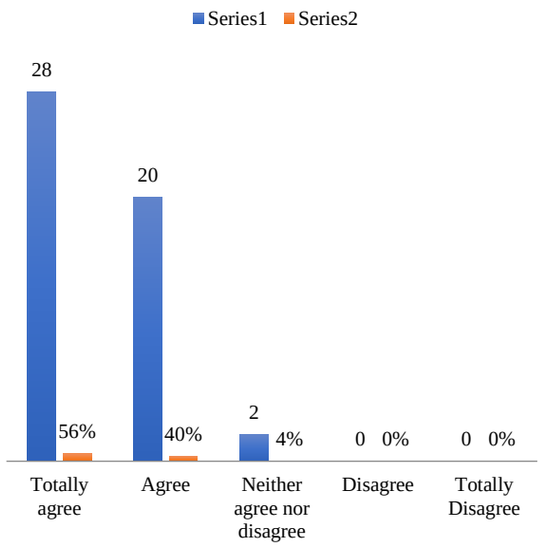
Findings

This section presents the outcomes obtained from the questionnaire according to the above model analysis.

The TikTok tool updates the English teaching-learning process

Three sections show the positive results of TikTok based on students' perceptions.

Promotion of an active and innovative methodology

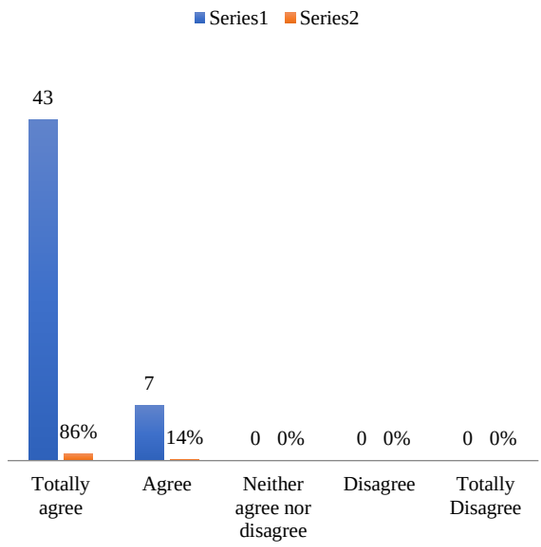


Graph 1 Active and innovative methodology

The satisfaction level that stands out most among the students is 56%, who agree and perceive the active and innovative methodology and followed by 40% in agreement and 4% who did not take a position.

At this point, 28 students conceive TikTok as an alternative for the teaching-learning processes (Navas *et al*., 2015) in remote education, enabling self-regulated learning, alluding to a context through augmented reality, innovative dyes such as music and non-verbal expression, which contribute directly to the communicative competence.

In this innovative methodology, 40% of the sample register changes regarding teachers' roles to incorporate emerging technologies in virtual and hybrid education and satisfy the students' cultural requirements (Moreno and Galván (2020). Indeed, students recognize their learning process as dynamic and active thanks to such a role in virtuality, being content curators by adapting the teaching resources (Viñals and Cuenca, 2016), learning styles, communication skills, and making the bridge between prior and new knowledge.



Graphic 2 Interactive material according to the educational modality

86% agree that TikTok presents interactive material and promotes significant long-term learning, giving rise to a new learning culture, as indicated in the study by Cedeño (2017). Additionally, 14% of the sample consider the tool fosters collaborative knowledge construction where the educational praxis turns into oral interactions. However, they also point out the importance of three elements to working with Tiktok such as pedagogical, technological, and organizational (Babativa and Laurencio, 2017) in such a way that the first allows them to align the teaching-learning purposes.

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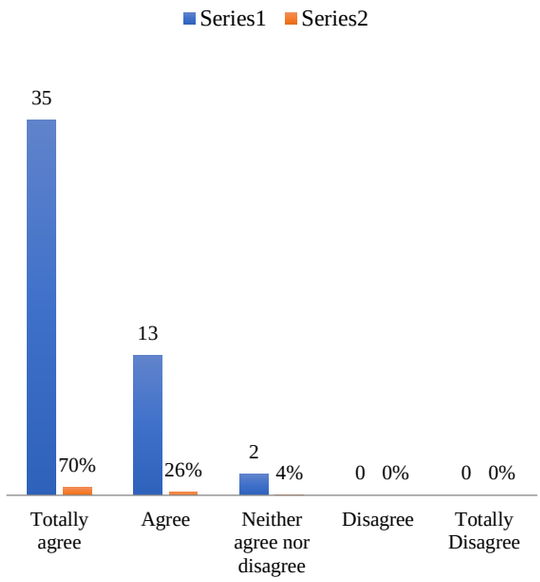
The second is the medium to enable the transmission of know-how and the latter provides the criteria for the ICT usage. The participants conceive these criteria as essential for integrating virtual and face-to-face activities. Last but not least, they characterize Tiktok as innovative thanks to sounds and images which adapt to any content.



Graphic 3 Ubiquitous learning

Another factor contributing to updating the teaching process is ubiquitous learning since it promotes knowledge at any time and place, being mediated by technology.

In this regard, 70% of the sample indicates the contextualized knowledge with historical and cultural overtones (Ávalos, 2017) as the most notorious characteristic of TikTok, which stimulates a broader understanding of the appropriate use of English by creating significant long-term learning experiences.

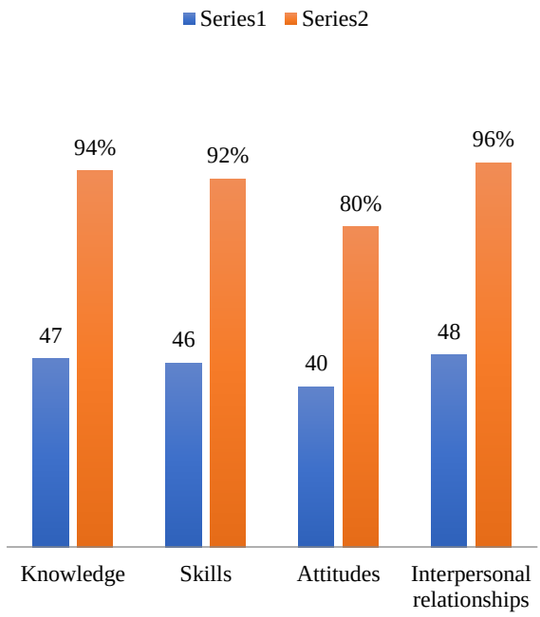
In addition, it adapts to the users' levels and previous knowledge through a personalized self-regulated learning environment according to their styles.

Meanwhile, 26% agree with the ubiquitous learning of the application by feeling motivated and even increasing their commitment and willingness to design content and evaluate their peers, strengthening their intercultural skills by respecting social, cultural, and ethnic differences (Zapata-Ros, 2014).

Finally, 4% remains neutral and does not indicate any possible use of the tool. However, 48 out of 50 classify it as potentially techno-pedagogical means for education and access to knowledge for meaningful long-term learning.

Skills promoted by TikTok

In this category, students point to the communicative skill as the most developed one.



Graphic 4 Communication skill components

This skill allows students to express ideas or points of view according to a specific context in society. That is why it repeatedly represents an obstacle for foreign language students who know grammatical rules systematically and have rich lexical baggage because of instructional training but make mistakes when using them, affecting the communication process. Given this situation, the need to contextualize the teaching-learning process is imminent. In this case, most of the sample identified different elements that enable communicative competence in context. 94% indicate that the TikTok tool increases their cognitive and metacognitive knowledge, as well as control and compensatory mechanisms to break down communication barriers and achieve appropriate oral interaction.

They also work on knowledge construction through experiential learning and technology-mediated practice with significant activities (Santiago, 2015).

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In addition, 92% affirm that the app fosters communication skills through strategies such as maintaining eye contact with the audience to facilitate dialogue, transmitting clear and concise ideas due to the video, and the non-verbal language, supporting the message. Indeed, they promote discursive and sociocultural skills. Regarding the first, participants recognize Tiktok's advantages to writing using grammatical structures and correct meaning (Adán, 2014). Another essential finding is the development of argumentative, narrative, or descriptive skills.

Regarding the second, students consider TikTok as a source of content socialization and sociocultural exchange of reality, practicing expressions in communicative acts.

They also mentioned that their fear and anxiety when speaking have decreased due to TikTok, which provides confidence by editing their interactions before sharing the final version.

Although TikTok is an application that absorbs time, if this feature takes place for educational purposes, it could influence users' motivation, connecting the teaching process with learning.

Further, 80% denote a positive increase in their attitudes to speaking in English. Some describe the emotion they experienced (Ahlse *et al*., 2020; Flores-González, 2021) from social networks. In this sense, their commitment to work was evident because social networks would spread their work with colleagues or other communities. As a result, students demonstrate a high degree of effort with the command of the language.

Moreover, they perceive the activities carried out as something positive with significant learning, identifying the difference between traditional and rote learning.

Finally, 96% commented that the tool fosters interpersonal relationships for oral production when working as a team in designing and interacting in collaborative videos, prioritizing communicative competence.

In short, the outcomes show different components to enable technology-mediated oral production in a foreign language.

Regarding the above, the contributions of the present study are the following: The tool is a didactic strategy to encourage critical thinking, implying a new vision to use it transversally in other subjects or as an evaluation strategy to review and provide feedback to peers or even for themselves as content creators.

Finally, the use of the tool is a theoretical contribution to the approach to learning oral production with an interactive and innovative methodology for updating the teaching of English as a foreign language.

Conclusions

The results confirmed the study hypothesis. Regarding it, the conception of TikTok is to update the learning process with an active-innovative methodology and interactive materials adjusted to the educational modalities for students to achieve ubiquitous learning and perform successfully in oral interactions.

Last but not least, the findings provide relevant information to implement actions or changes that benefit both students and teachers in technical skill development in favor of appropriate educational practices according to the required modalities.

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Process of staff activities National Electoral Institute in electoral jorganda

Proceso de actividades personal Instituto Nacional Electoral en jornada electoral

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Abstract

With this project, the objective was to know the process of activities carried out by the staff on the National Electoral Institute on an electoral day so that Mexicans at the national level know what and how these activities are carried out on an electoral day that could even work at a national and international.

Actividades, Personal, Proceso, Tecnologías de la Inormación

Resumen

Con este proyecto se tuvo como objetivo conocer el proceso de actividades que realiza el personal del Instituto Nacional Electoral en una jornada electoral para que los mexicanos a nivel nacional e internacional conozcan qué y cómo se realizan estas actividades en una jornada electoral que incluso podría funcionar a nivel internacional.

Activities, Staff, Process, Information Technologies

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Introduction

For years, Mexico has had the National Electoral Institute -INE- in charge of organizing the federal electoral processes. In order to cast, for any candidate of the various political parties that exist, the vote on an established day and time.

As mentioned by the author Sarango (2021:14) in the day to day there is a world surrounded by technology, since there are more cell phones, personal computers, Tablet, Smart, Smart than people and adding too many devices or devices that allow sending information in real time to anywhere in the world in seconds of time.

Therefore, the objective was to know the process of activities carried out by the personnel of the National Electoral Institute during the Election Day. And thanks to this process, we continue to have clean electoral days and with the peace of mind that those who participate in them were responsible citizens according to Bonilla-Toralba (2021:13). Due to this circumstance, with this research concluded, the process was known and is made known as a result so that Mexicans at a national level know what and how the process is carried out in an election day, which could even work at an international level.

2. Literature Review

For the authors Hondge, B., Anthony, W. and Gales, L. (2001:7) there are three key points about the nature of organizations and businesses, the first: they are composed of individuals, secondly the division of labor among the members of a business is a decisive aspect and a third point is composed by the importance of the goals and objectives for the same organization. An organization or business can then be defined as: two or more people divide the work among their individuals and pursue shared goals.

The author Nepomuceno, (2001), defines information as a fundamental concept of cybernetics, and this in turn, is the science that studies machines and living beings from their ability to perceive and retain information, transform it into signals and transmit them through communication channels so that a particular purpose is fulfilled.

Computer science or information technology is the science that studies the techniques and automated processes that act on data and information (Suarez, R. 2007).

If the National Electoral Institute recognizes the interest, commitment and responsibility shown during the training course and under this circumstance the appointment as President of a polling place has been received.

It is noble to recognize the commitment exercised by the INE personnel who visited, notified and trained before an election day and therefore it is necessary to establish the process that the personnel should have carried out to carry out a very excellent election day in order to know the accumulation of activities that the INE personnel carried out. And that they are promoted to changes of assignment if necessary and to rotations due to the needs of the service of independent professional service personnel. Executive, J. G.(2022)

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If as president of a polling place board, Article 85 of the General Law of Electoral Institutions and Procedures in subsection a), establishes that as electoral authority , one has to preside over the work of the board and ensure compliance with the provisions contained in the aforementioned law throughout the development of an election day. Then the ability arises that there will be a collaborative work that must be performed in the polling place that is presided and thus the INE personnel working as a team with the president of the polling place, then the attributions that must be performed in the polling place, established in articles 85, 86 and 87 of the aforementioned law, will be achieved. And that are sustained in our Political Constitution of the United Mexican States in articles 5, 36 and 41.

Methodology

According to the authors (Hernández, *et al*. 2018) the following hypothesis was established for this work: The Process of Activities of INE personnel is carried out according to the information handled in the Institute's technology systems. Then the following variables were established: dependent. The Process of Activities of INE personnel and independent. The Institute's technology systems.

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The starting point of the methodological strategy used in the research, to focus on reality, laws and interconnections, since it was thus intended to build an epistemological perspective from which the different dimensions of reality and their interrelationships can be delineated, better understood.

Therefore, we have the relationship between:

a. National Electoral Institute
b. Information technologies
c. Polling place
d. Municipal, national and international context

Thus, visualizing the municipal, national, international and National Electoral Institute contexts, it was possible to determine the dimensions, known as variables that intervened in this research and that were indicated at the beginning of this aspect, with the following characteristics:

Dependent variable: Process of INE personnel activities.

This variable indicates that for the case studies considered in the work there were polling stations and therefore they have the characteristic of having a president. And another characteristic is: the presidents of polling places can act in them to come out ahead in the face of any circumstance and carry out a clean election day, where according to the authors Benitez, Benitez & Botero (2021:45) the values that managed to be strengthened during an election day were communication, respect and solidarity.

Independent variable: Institute technology systems.

A case study of a polling station was carried out; in this research, a plan of action was drawn up in the field for the polling station with the purpose of collecting information by devising a strategy of approaching the president of the polling station and the INE personnel (observation or immersion in the field). (observation or immersion in the field). The approach strategies to understand the phenomenon in the polling station environment were executed in the following way:

In order to describe and understand the detailed means through which the president of the polling place and the INE personnel, act in a significant way for the polling place and in the scope of the use of the technologies that they created for the same. Contact was established with the president of the polling place and once the first interview was held, sufficient interviews continued to be conducted to obtain the necessary information for approximately three months and is presented below.

Results

In the function of president of a polling place, article 85 of the General Law of Electoral Institutions and Procedures, in subsection a), establishes that as electoral authority, the president must preside over the work of the polling place and ensure compliance with the provisions contained in the aforementioned law throughout the development of an election day. From this moment on, the ability of the presiding officer to develop the teamwork and/or collaboration that must be carried out in the polling place where he/she is the presiding officer arises. In this way, the attributions that each one of the officials of the polling place has established in articles 85, 86 and 87 of the aforementioned law can be achieved.

As president, in order to achieve this collaborative and/or team work with the polling place officials, it is necessary to give an example of an adequate integration with all the polling place officials, and therefore it is possible to mention the existence of a process of integration of the other FMDC (polling place officials) which is the result of the work carried out by the INE personnel to carry out the Election Day and which became the following process.

Figure 1
Source: Prepared by the authors

Discussion

The staff of the National Electoral Institute has to carry out a series of activities that led them to conform the process of them to carry out a smooth election day using the means of information technology.

Conclusions

With this research, a process of activities was carried out, which indicates that in the face of any circumstance on a daily basis, INE has personnel carrying out activities to continue to carry out smooth election days.

Information technologies can influence improvements in organizations, if they are available, and in this work, the National Electoral Institute has them. That is why it is expected to carry out election days in time and form.

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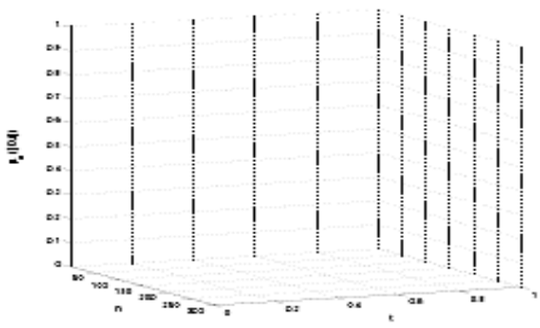

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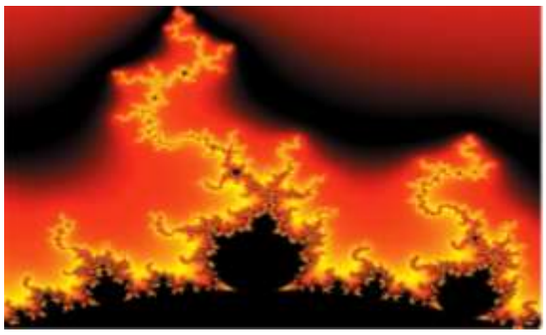

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