SHORT PAPER

Voice Analytics for the Identification of University Student Satisfaction, from WhatsApp Audio Messaging

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ABSTRACT

In the context of virtual teaching during the COVID-19 pandemic, a gap emerged between students and teachers due to social distancing measures. This gap hindered the flow of information about the teaching-learning process, making it difficult for authorities to make informed decisions to improve student satisfaction and teaching performance. In this context, the widespread use of mobile applications, through which students express their opinions on the conditions of their learning sessions, is significant. In this sense, the objective of this paper is to apply voice analytics to identify the factors that contribute to the lowest level of student satisfaction in teacher performance using WhatsApp audio messaging. The study has a quantitative approach, an exploratory-descriptive level, and a non-experimental cross-sectional design. The study population consisted of 33 students. It was determined that the factor with the lowest level of satisfaction is the dimension "class session administration," with a percentage of 57.58%, which is significantly lower than the satisfaction levels of the other factors analyzed, which are above 90%. Therefore, it is concluded that in addition to using rubrics to evaluate teacher performance in adhering to lesson plans and class sessions, the authorities should also implement regulations that support the use of voice analytics through mobile applications like WhatsApp. This will provide insights from students, who are direct participants in the teaching process, regarding their perception of teaching performance.

KEYWORDS

student satisfaction, teacher performance, voice analytics, voice messages, WhatsApp

1 INTRODUCTION

Educational quality in higher education institutions is one of the most important factors contributing to student satisfaction [1]. The face-to-face teaching system was interrupted with the arrival of COVID-19. As a consequence, many institutions migrated to virtual teaching, which had an impact on educational quality [2, 3].

Many institutions had deficiencies in adopting the virtual modality due to their technological infrastructure [4]. Therefore, it is necessary to assess student satisfaction in order to diagnose the quality of the services provided and make necessary adjustments and improvements [5]. Teacher performance is one of the most relevant factors in educational quality [6]. In these times, class sessions have changed due to the influence of new technologies in education, which has required greater training for teachers [7]. Therefore, evaluating student satisfaction regarding teaching performance will provide feedback on the difficulties associated with the teaching process [8]. Teacher performance has a positive impact on academic performance and reduces the dropout rate by identifying the needs and barriers faced by students [9].

Currently, one technique used for identifying student satisfaction is sentiment analysis [10]. This technique falls under the area of artificial intelligence and is closely related to natural language processing (NLP) [11]. Sentiment analysis enables the analysis of opinions and emotions related to a specific service [12]. In addition, it is related to social networks or mobile instant messaging applications, which serve as a source of data to be analyzed and from which information can be extracted [13]. Therefore, it is a useful tool for identifying the emotions of the students during class sessions [14]. WhatsApp is an instant messaging application that enables synchronous or asynchronous communication between users [15]. In addition, it is a platform where students can freely express their opinions about their satisfaction with the services provided by the university [16]. Through this application, opinions can be exchanged in various formats, including texts, images, videos, and voice [17].

Based on the indicated information, this research aims to utilize voice analytics to identify the factors contributing to a lower level of student satisfaction with teaching performance using WhatsApp audio messaging. Methodologically, the study adopts a quantitative approach with an exploratory scope and a non-experimental design. This is because the study does not involve manipulating the variable under investigation. Therefore, the research questions formulated for this study are as follows:

- RQ1: What are the percentages of satisfaction for each factor analyzed in teacher performance using voice analytics?
- RQ2: What is the teacher performance factor with the lowest level of satisfaction, as identified through voice analytics?

2   CONCEPTUAL FRAMEWORK

Voice analytics is a form of voice signal processing that extracts and analyzes voice data in order to deliver useful information [18]. The importance of customer feedback in organizations lies in its ability to enhance decision-making by acquiring knowledge about the customers' opinions on the products or services offered [19]. In the educational field, it contributes to providing feedback on academic services by extracting positive, negative, and neutral feelings from voice messages of students stored in various mobile applications [20]. Voicemail sentiment analysis is a data mining technique that determines people's emotions from their voicemail [21]. It utilizes an automatic learning algorithm to identify patterns in voice messages to classify people's feelings [22].

Student satisfaction is defined as the various aspects (academic, administrative, and others) that arise from the academic experiences of students, both within and outside the university [23]. When these aspects are addressed promptly, they make a significant contribution to the quality of education [24]. In addition, it helps students improve their academic performance, critical thinking skills, and understanding of the topics [25].

3 METHODOLOGY

3.1 Approach, scope, and research design

In this study, a quantitative approach was used to identify the satisfaction of students with teaching performance. It was done by assigning weights to the emotions expressed in each voice message generated by the students. The scope of the research is exploratory. This is because it aims to understand and identify the factors that influence student satisfaction with teacher performance using WhatsApp voice analysis. The research design used is non-experimental because the study population was not manipulated. It is a cross-sectional study because the opinions of the students, represented by voice messaging in the WhatsApp mobile application, were collected during a single period of time—the last week of class for the automatic process control course in the 2022-II academic semester.

Regarding the data collection instrument, the questionnaire validated in [26] was used, which was suitable for the purpose of the investigation. This questionnaire contains five open questions, which are shown in Table 1.

Table 1. Questionnaire of open answers through voice messages in the WhatsApp mobile application

N°	Factors	Questions
1	Planning	What aspects of teaching performance demonstrate that you strategically plan your activities to ensure that students acquire the competencies established in the subject?
2	Didactic Strategies	What didactic strategies does the teacher use during class sessions to help students acquire relevant knowledge, skills, and attitudes in the subject?
3	Communication	What aspects related to teacher communication contribute to creating a conducive environment for student learning?
4	Class Administration	What aspects of the teacher demonstrate that he effectively manages his class session and how do they contribute to student learning?
5	Professional and Personal Traits	What personality attributes or attitudes did the teacher demonstrate as a professional to interact with the students during the class session?

3.2 Data processing method

Figure 1 illustrates the data processing method, which involves collecting voice data from 33 students regarding their opinions on various factors related to

teacher performance. The messages were stored in a Python software database. Then we proceeded to the application of voice analytics, which consisted of three stages: the first stage consisted of the adaptation and pre-processing of messages from voice format to text format. Then, in the second stage, data processing was carried out. This involved extracting the sentiments expressed in each response from the students who completed the questionnaire. Each answer was assigned a numerical value on a scale ranging from –1 to 1. In the third stage, the responses of the students were categorized according to their polarity. Responses with a negative level of feeling were labeled as "dissatisfied," responses with positive level of feeling were labeled as "satisfied," and responses with a neutral feeling of 0 were labeled as "neutral." Finally, we proceeded to identify the factor with the lowest level of teacher performance.
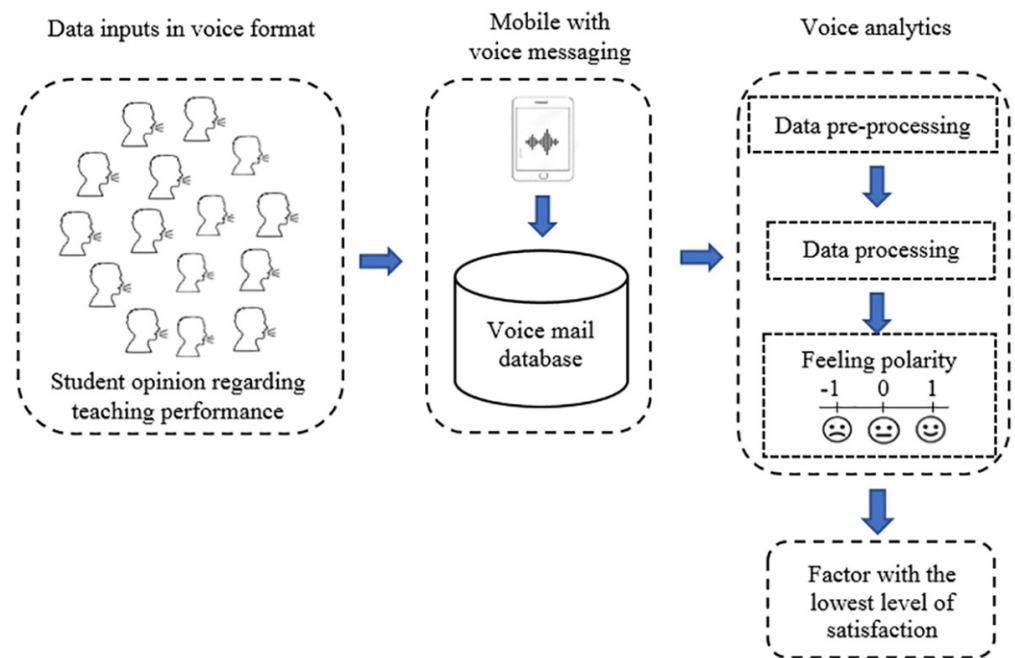

Fig. 1. Method used for data processing

4 RESULT AND DISCUSSION

4.1 Results of the sentiment analysis

Figure 2 shows the results of applying voice analytics to each student response and analyzing each factor. It is important to specify that, as indicated in the method used for data processing, the collected data is in voice format. Therefore, it was converted to text format through preprocessing. These texts can be viewed in Figure 2, which simplifies the transformation results by only showing the first five responses of each student. In addition, as part of the results of processing textual data, the quantitative value contained in each student's response is displayed. Based on these results, each weighted sentiment can be categorized, and the teacher performance factor with the lowest level of satisfaction can be identified.
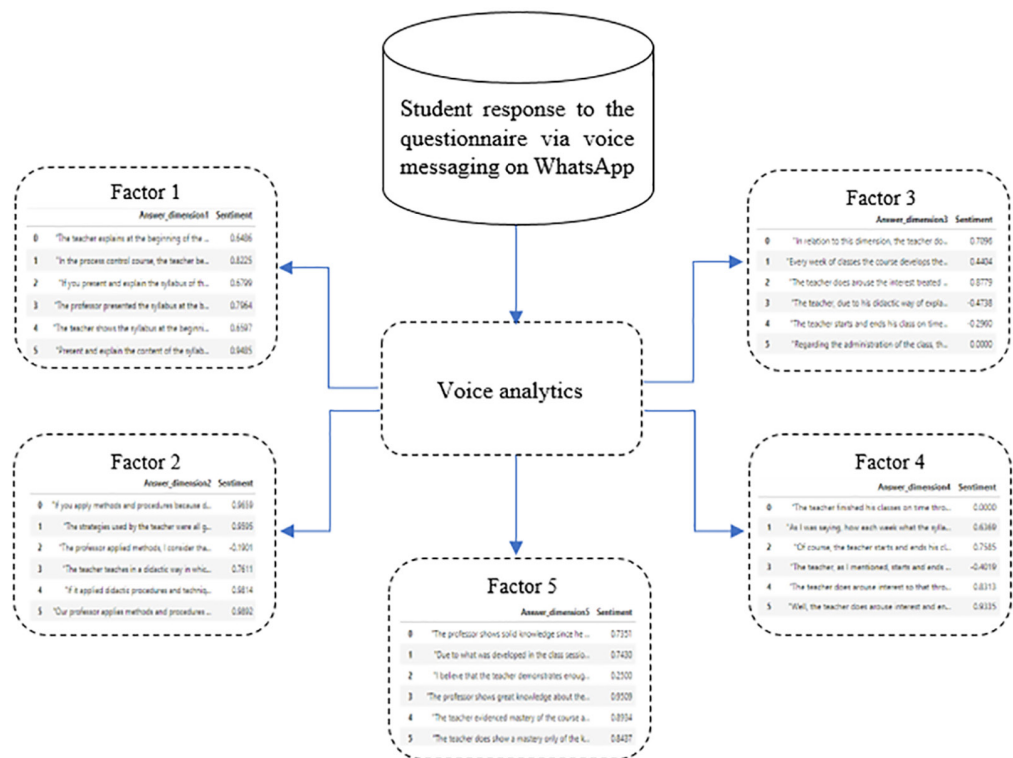
Fig. 2. Weighting of the feelings expressed in the students' responses through factor analysis

Figure 3 shows the percentage distribution of the polarity of feelings analyzed by factor. It is possible to identify that out of the five factors under study, the one with the lowest level of positive polarity is factor 4, or "class session administration," with a percentage of 57.58%. This is followed by factor 3, or "communication," with a percentage of 90.91%. In addition, the factor that exhibits a higher percentage of positive polarity is factor 1, also known as the "planning" factor. The "professional and personal characteristics" factor also demonstrates a high percentage of positive polarity, both scoring 96.97%.
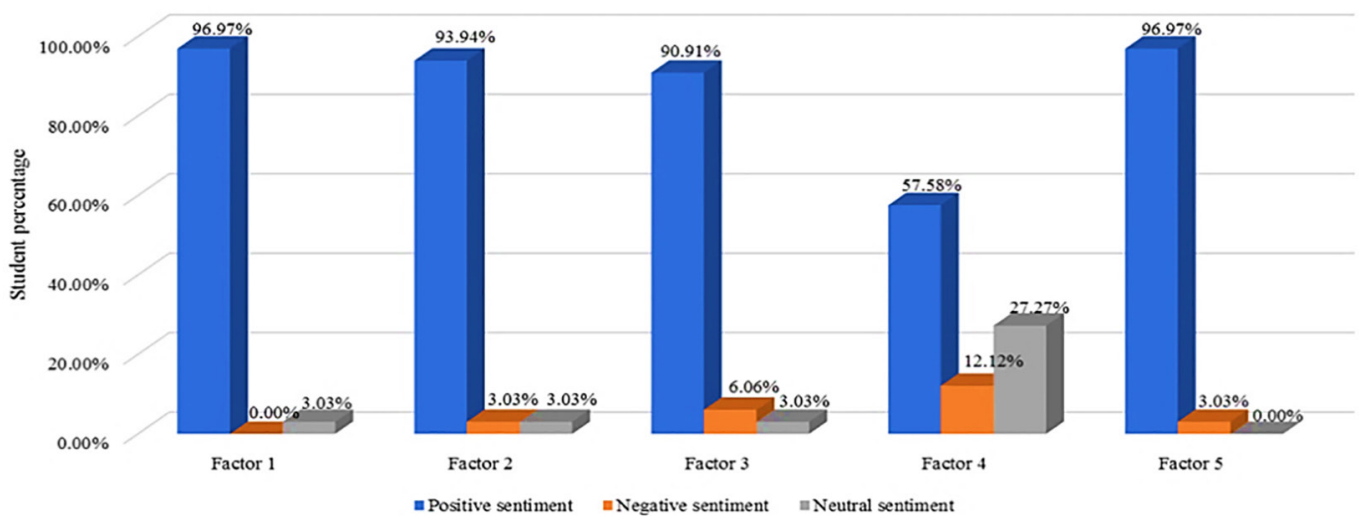

Fig. 3. Percentage distribution of feelings analyzed by factor

4.2   Discussion

In relation to the factors that contribute to lower levels of satisfaction in teaching performance in the context of virtual teaching, it was found that out of the five factors analyzed in this study, the factor "class session administration" had a satisfaction rate of 57.58% among students, making it the only factor with a high level of dissatisfaction. In this regard, in [27], it was concluded that the level of student satisfaction with respect to teaching performance is 57.27% in the context of virtual teaching during the COVID-19 pandemic. Although this cited research only used a single question on teacher performance, sentiment analysis was able to extract factors that influence teacher performance, one of which is the "tools used as part of teaching didactic strategies." It should be noted that, although there is a coincidence in the percentage of satisfied students with respect to teaching performance, the means used to collect data in this research was the WhatsApp mobile application through its voice messaging, while in the research being referred to, the Twitter mobile application was used through its text messaging.

This performance and this research demonstrate the feasibility of using the WhatsApp mobile application to collect data on teaching performance and generate knowledge for decision-making by authorities or university directors. The data is based on students' opinions regarding their satisfaction and level of expectation achieved in the context of virtual teaching. In this regard, [28] affirms that the use of the WhatsApp mobile application contributes significantly to closing gaps in terms of improving learning in the context of virtual teaching. Through this technological tool, authorities can apply corrections or provide feedback measures to enhance the academic service offered. In the same line of thought, [29] and [30] point out that the use of text messaging through the WhatsApp mobile application is beneficial for communication between students and teachers. It serves not only as a means of information, but also as a tool for organizing and actively participating in academic or research projects, thereby promoting teamwork.

5   CONCLUSION

Based on the results obtained from the factor of the lowest level of student satisfaction regarding teaching performance, it is concluded that the university authorities should implement supervision and monitoring strategies to ensure the specific execution of class session plans. This includes using evaluation rubrics to assess teacher performance in terms of compliance with class session plans. For example, it is important to determine if teachers start and finish their class sessions at pre-established hours, as well as if they focus on the development of topics defined in the syllabus and not on unrelated academic content.

Thus, it is also concluded that, in addition to using rubrics to evaluate teaching performance in accordance with class session plans, authorities must also implement regulations or policies that support the use of voice analytics through mobile applications. One example of such an application is WhatsApp, which can provide insights from students as direct participants in the teaching process.

6   ACKNOWLEDGMENT

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