Frontline Services Performance Assessment Utilizing Numerical Analysis and Text Analytics

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ABSTRACT

For any service provider, their success can be attributed to the way they handled their clients. This is especially much more evident when talking about frontline services. Typically, service performance is assessed via survey forms with numeric metrics –- usually Likert scales in different forms (star ratings, etc.). Nowadays, with the advent of technology, performance evaluation of service providers takes the form of reviews – usually composed of a comment section with or without numerical ratings. This study proposed a new method of evaluating performance of frontline services in Pangasinan State University – Urdaneta City Campus utilizes two methods a quantitative method using numerical ratings on the survey and a qualitative analysis using of text analytics on online feedback of clients. Further, this study also investigated the difference and agreement of the two methods of assessment. Results show that some frontline services are more appreciated in some areas while there are also frontline services which needs to improve in several aspects. Though the survey data generally show an aggregate satisfactory rating, the results of the sentiment analysis of online comments sometime says otherwise. This means that the numerical evaluation may be useful in determining priority aspect or service for improvement and the sentiment analysis can be used to determine problems which needed immediate action.

Key words : frontline services, numerical evaluation, performance assessment, sentiment analysis

1. INTRODUCTION

Customer satisfaction and consumer preference may have been the key factor in determining whether a service provider will succeed or not. It can be considered is the primary concern of any organization. Moreover, front line services serves as the face of any institution catering to clients. State Universities and Colleges (SUCs) and even private universities are examples of such institution. The prestige they carry does not simply come from their names but are due to the collective feedback of the clients – especially their students. As [11] had said, greater emphasis shall be exerted on satisfying the needs and

expectation of the customers of educational institutions – the students. In fact, studies done by [7]-[10] show that universities must understand student satisfaction as it can determine strong points to market and weak points to improve. This is crucial since universities 'compete' to attract students and students tend to stay when the university have delivered the services in accordance to the student standards. And these standards are measured through satisfaction surveys, typically done on a regular basis. On the other hand, customer satisfaction can be regarded as an expectation about a service or a product [3],[4]. [5] even stated that customer satisfaction serves as a driver of financial performance. Customer satisfaction is usually measured by administering surveys, forms or questionnaires to clients. Such questionnaires typically use numeric values which translates into different levels of satisfaction. Assessment of customer satisfaction and feedback can be done in several ways. Latent variables are usually determined by employing the SERVQUAL model – focusing on the five key dimensions: tangibility, reliability, responsiveness, assurance, and empathy [22]. The derived latent variables are usually then rated using a Likert scale. Several quantitative measures have been used to assess customer satisfaction. Numerical descriptors like frequency, averages, and ranges are some of the dominant metrics. Comparative methods have been observed like t-tests, analysis of variance, and like, especially when comparing satisfaction across the five key dimensions [22]. Impact of variables to other variables are investigated using advanced quantitative methods like Structural Equation Modeling [13], Bayesian Analysis [14], and Regression and Neural Networks [15], among many others. Qualitative techniques have also found their way into customer satisfaction analysis. The group of [16] investigated telecommunications customer satisfaction by employing thematic analysis on semi-structured data. Menon and [17] and [18] utilized phenomenological approaches in dealing

with customer satisfaction. With the advent of technology, marketing has taken root in social media. Where there is a market, there will be feedback, hence, customer satisfaction has also assumed a new form – reviews, comments, and ratings in social media platforms. Social media has made customer satisfaction even more important, because the scale has become global [12]. Whether it be reviews, comments, and ratings, there is a need to assess customer satisfaction using these. Text analytics even brought qualitative measures to wider use, mainly due to the existence of the internet and social media[23]. [19] discussed the usage of text analytics in the area of customer satisfaction. Online reviews, when broken down using latent semantic analysis, are found to provide insights about factors that affect satisfaction or dissatisfaction of customers towards a particular service [20]. Meanwhile, [21] and [24] used a structural topic model leading to information about customer dissatisfaction. One way to analyze online customer feedback, especially comments, is by the use of sentiment analysis. [2] defined sentiment analysis as an area dealing with judgments, responses, and feelings, which can be inferred from text data. This is theoretically and practically useful when classifying responses about a particular topic such as being *favorable, unfavorable,* or *neutral*. This is advantageous in case there is no available numerical ratings, and even can be used to validate results of a survey.

Pangasinan State University, one well-known State University in the Philippines, aims to continuously be a haven of quality learning and to produce generations of successful professionals. In order to achieve this, it is not enough to simply improve the infrastructures and facilities, but it is necessary to monitor the services the university offer. This is particularly true for services availed by the students – the frontline services. This study deals with the monitoring of five frontline services offered by the university – Library, Cashier, Student Services, Security, and Maintenance.

2. OBJECTIVES OF THE STUDY

This study aimed to new method of evaluating performance of frontline services delivery of Pangasinan State University – Urdaneta City Campus (PSU-UCC) using a quantitative and a qualitative procedure. Specifically, this study was conducted to:
   a. describe the frontline services delivery of PSU-UCC based on customer satisfaction form responses; specifically, in terms of
      i. Tangibles;
      ii. Reliability;
      iii. Responsiveness;
      iv. Empathy; and
      v. Physical Aspect.
   b. analyze Frontline services delivery of PSU-UCC based on online sentiments evaluated through text analytics; and
   c. compare the results of the two methods.
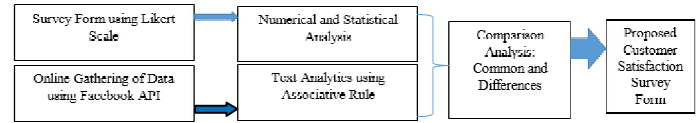
3. METHODOLOGY

Figure 1: Research Paradigm

3.1 Research Design

This study utilized a combination of descriptive and exploratory designs. The descriptive part is for the characterization of the survey data and is useful in the assessment of frontline service delivery. The exploratory part is for the sentiment analysis on the comment data, which primarily aims for the extraction of association among items in the dataset.

3.2 Source of Data

Data used in this study comes from two sources – one set gathered from customer satisfaction survey forms and another set taken from Facebook.

The first dataset was composed of 400 students' feedback taken thru a survey with the students selected via stratified random sampling. The form consists of aspects and each aspect has several indicators, some of which adapted from [6], relating to the delivery of the frontline service. The questionnaire zooms in on the following dimensions of frontline service delivery
   a. Tangibles – Physical facilities and equipments
   b. Reliability – Dependability and accuracy of the service.
   c. Responsiveness – Frontliners' willingness to help.
   d. Empathy – The extent of kindness given to clients.
   e. Physical – Grooming and communication
and each were given a rating using a three-point Likert scale.

The second data set was composed of comments taken from two Facebook pages. The first is the official Facebook page of the campus -- Pangasinan State University – Urdaneta City Campus while the other one is a confession page – PSU Real Deals. The criteria in selecting comments (typically from posts with large number of comments) are as follows:
   a. comments must be about frontline services of the campus;
   b. comments must be written in English, Tagalog, or combination of the two;
   c. comments must be posted by several entities;
   d. comments must be composed of at least two words; and
   e. comments can be duplicated but only one shall be considered.

Figure 2: The Official Facebook Page of the Campus

3.3 Treatment of Data

In order to attain the objects of the study, the following procedures were implemented.

3.4 Survey Data

The survey data (first dataset) was analyzed using descriptive statistics. Characterization of the customer feedback was achieved by using frequency counts and weighted averages. Latent variables were given descriptive equivalents by employing the description map below.

Table 1: Interpretation of the Results of the Customer Satisfaction Survey

Weighted Average Range	Description
1.00 – 1.66	Not Satisfied
1.67 – 2.33	Satisfied
2.34 – 3.00	Very Satisfied

3.5 Text data

3.5.1 Data Cleaning and Data Processing

The comment data was first compiled and undergoes pre-processing. Pre-processing refers to the method of removing "unwanted components" or "noise" from the dataset. Noise can be defined as parts of the comment that are irrelevant and hence becomes disruptive. Noise can come in the form of symbols, links, emoticons, and even other words. Pre-processing takes the form of any combination of the following:

a. Data Cleaning

This refers to removal of symbols, punctuations, foreign characters, links, emoticons, numbers, and extra whitespaces.

b. Stop Word Removal

This pertains to the removal of irrelevant words known as stop words. These usually take the form of prepositions, articles, and other common but not-so-meaningful words.

c. Stemming

Another pre-processing procedure takes the form of stemming. It is the procedure of converting words into their root forms, i.e., removing prefixes and suffixes. For instance, the words "selection", "select", and "selective" are technically different, however, they embody the same concept and are all converted to the word "select".

d. Transformation into Common Case

This pre-processing method transforms the terms into a common letter case – usually into minuscule (lowercase) form. This is used to avoid generating distinct words due to differences in letter cases. For example, the words "DATA" and "data" are typically treated as two different words, to avoid this, we convert everything into lowercase (or uppercase).

3.5.2 Text Analysis

After undergoing pre-processing, the resulting dataset then undergoes a procedure called association mining. [1] defined association mining as a process of finding correlations among items in a dataset. This process is further divided into two steps:

a. Frequent Items Analysis

This method refers to the extraction of the dominant entities in the dataset. In this study, these entities are most commonly used words in the comments of students.

b. Association Analysis

This method pertains to determination of highly correlated frequent items/words. These correlated words will form rules that will enable one to predict the sentiment embedded in the comment.

The extraction of the association rules can be done using different algorithms. This study implemented the A Priori algorithm which utilizes the frequency of the item sets (group of frequent items) determined from Frequent Items Analysis. The metric for the association rule selection will be the confidence value, which is mathematically defined as

$$C(X \rightarrow Y) = \frac{Frequency\ of\ X\ with\ Y}{Frequency\ of\ X}$$

which can be interpreted as the chance that Y (confidence word, antecedent) appears given that X (support word/precedent) appeared. The confidence value can then be practically interpreted as the tendency of Y to occur whenever X happens.

After the association analysis, the resulting dominant words and rules are **annotated**. Annotation pertains to the process of setting whether a term implies a positive or negative response – in this case, about the frontline service delivery of the campus. The annotation was done by simply labelling negative words as -1 and positive words as 1, these are called the sentiment values of the terms. The sentiment value of the word combinations is simply the sum of the sentiment values of the component words. If the sum is positive, the word combination implies a positive sentiment, if it is negative so is

the sentiment. In case it is zero or somewhat close to zero, the sentiment can be treated as fair or neutral one.

4. RESULTS AND DISCUSSION

A. Library Services

Table 1: Survey Results for Library Services

Indicators	NS	S	VS	AWM	D
Tangibles					
Well Ventilated	71	268	61	1.98	S
Spacious	76	264	60	1.96	S
Accessible	43	271	86	2.11	S
Clean and Orderly	19	242	139	2.30	S
Composite Mean				**2.09**	**S**
Reliability					
Processing Time	39	284	77	2.10	S
Accuracy of Records	25	286	89	2.16	S
Always ready to render services to students	52	245	103	2.13	S
Punctuality	37	272	91	2.14	S
Composite Mean				**2.13**	**S**
Responsiveness					
Sufficient number of staff to assist you	101	246	53	1.88	S
Queries/Requests are dealt efficiently and promptly	47	304	49	2.01	S
Availability of Channels for expressing student complaints	93	259	48	1.89	S
Provides information/dissemination for services offered and important announcements	68	268	64	1.99	S
Composite Mean				**1.94**	**S**
Empathy					
Working for extended hours	89	266	45	1.89	S
Staff are fair and unbiased	58	269	73	2.04	S
Sincere interest in solving students' problem and willingness to help	72	261	67	1.99	S
Staff always approachable	74	241	85	2.03	S
Composite Mean				**1.98**	**S**
Physical Aspect					
Well – groomed	26	272	102	2.19	S
Wears appropriate, clean and neat attire	24	249	127	2.26	S
Modulated voice	32	269	99	2.17	S
Pleasing appearance	20	258	122	2.26	S
Composite Mean				**2.22**	**S**
Overall				**2.07**	**S**

Legend :
NS-Not Satisfied, S-Satisfied, VS-Very Satisfied, AWM-Average Weighted Mean, D-Description

Note: 1.00 – 1.66: Not Satisfied, 1.67 – 2.33: Satisfied, 2.34 – 3.00: Very Satisfied

As one may glean from Table 1, the survey data shows that the students are *satisfied* with the services provided by the library. The students say that they are most satisfied with *physical aspect*, indicating that in general, the library staff are pleasing to the eyes. The services are also found to be reliable, with accurate records being provided. In terms of the tangibles, the library was appreciated in terms of *cleanliness and orderliness*. Moreover, the library services were also found to be satisfactory in terms of reliability and responsiveness. However, the library may want to improve in terms of the number of its staff (there are only two) since at least a quarter of the students find it not satisfactory.

Table 2: Association Rules for Library Comments

[Support Word] → [Confidence Words] (Confidence : Value)
[tahimik] --> [place] (confidence: 1.000)
[place] --> [tahimik] (confidence: 1.000)
[tahimik] --> [pero] (confidence: 1.000)
[pero] --> [tahimik] (confidence: 1.000)
[tahimik] --> [para] (confidence: 1.000)
[para] --> [tahimik] (confidence: 1.000)
[tahimik] --> [mag] (confidence: 1.000)
[mag] --> [tahimik] (confidence: 1.000)
[place] --> [pero] (confidence: 1.000)
[pero] --> [place] (confidence: 1.000)
[place] --> [para] (confidence: 1.000)
[para] --> [place] (confidence: 1.000)
[place] --> [mag] (confidence: 1.000)
[mag] --> [place] (confidence: 1.000)
[mga] --> [mababait] (confidence: 1.000)

As for the association rules taken from the comment data, the common combinations of words are formed by "tahimik" (silent), "place", "pero" (but), "para" (for), and "mababait" (kind) which are all having positive connotations. The confidence values are all 1.00, indicating that the words essentially occur together at all times. These words taken together imply that the library is a silent place with kind people, thus making it a conducive place for learning. This is in concurrence with the results of the survey data.

B. Cashier's Office

Table 3: Survey Results for the Cashier's Office

Indicators	NS	S	VS	AWM	D
Tangibles					
Well Ventilated	90	232	78	1.97	S
Spacious	143	225	31	1.72	S
Accessible	65	282	53	1.97	S
Clean and Orderly	43	297	59	2.04	S
Composite Mean				**1.92**	**S**

Reliability					
Processing Time	132	227	41	1.77	S
Accuracy of Records	53	286	61	2.02	S
Always ready to render services to students	97	251	52	1.89	S
Punctuality	89	268	43	1.89	S
Composite Mean				**1.89**	**S**
Responsiveness					
Sufficient number of staff to assist you	147	226	27	1.70	S
Queries/Requests are dealt efficiently and promptly	78	289	33	1.89	S
Availability of Channels for expressing student complaints	111	259	30	1.80	S
Provides information/dissemination for services offered and important announcements	84	277	39	1.89	S
Composite Mean				**1.82**	**S**
Empathy					
Working for extended hours	133	243	24	1.73	S
Staff are fair and unbiased	76	282	42	1.92	S
Sincere interest in solving students' problem and willingness to help	88	276	36	1.87	S
Staff always approachable	95	258	47	1.88	S
Composite Mean				**1.85**	**S**
Physical Aspect					
Well –groomed	43	292	65	2.06	S
Wears appropriate, clean and neat attire	36	287	77	2.10	S
Modulated voice	41	288	71	2.08	S
Pleasing appearance	47	282	71	2.06	S
Composite Mean				**2.07**	**S**
Overall				**1.91**	**S**

Legend:
NS-Not Satisfied, S-Satisfied, VS-Very Satisfied, AWM-Average Weighted Mean, D-Description
Note: 1.00 – 1.66: Not Satisfied, 1.67 – 2.33: Satisfied, 2.34 – 3.00: Very Satisfied

Students found the Cashier's Office to be satisfactory as indicated by the general weighted average of 1.91. The physical aspect seems to be the most appreciated part by students specially the wearing of clean and appropriate attire. Despite being assessed as satisfactory, the area needing the most improvement is the responsiveness aspect, having the least satisfactory rating among the five service delivery aspects. Even though the cashier's office incurred satisfactory performances in all aspects, attention must be given to the office space (limited space resulting to long queues), processing time (slow processing), number of attending staff (only two windows/staff are available), channels for student complaints (the only formal way to file complaint is thru customer satisfaction forms which are not administered to every client), and the working hours (the office rarely extends its services beyond 5 p.m.) as there is a relatively large proportion of students which are unsatisfied with these aspects.

Table 4: Association Rules for Cashier's Office Comments

[Support Word] → [Confidence Words] (Confidence : Value)
[mabagal] --> [process] (confidence: 0.524)
[process] --> [mabagal] (confidence: 0.550)
[naman] --> [lang] (confidence: 0.556)
[sila] --> [naman] (confidence: 0.600)
[window] --> [sana] (confidence: 0.692)
[yung] --> [lang] (confidence: 0.692)
[para] --> [sana] (confidence: 0.722)
[bayaran] --> [pila] (confidence: 0.818)
[mahaba] --> [pila] (confidence: 1.000)

In terms of the comment analysis, the most dominant rule is formed by the words "mahaba" (long) and "pila" (queue). The confidence value of 1.00 means that once the word "mahaba" is encountered, it is assured that "pila" will also appear. Other significant and dominant terms include "mabagal" (slow), process, "bayaran" (payment), and window. The aforementioned terms can be associated with negative emotions thus were given negative polarities, and further indicating negative feedback for the Cashier's Office.

The phrase "mahaba bayaran pila" (long payment queue), "window sana" (probably referring to the addition of windows), and "mabagal process" (slow process) coincides with the problems pinpointed in the survey data. However, survey data and sentiment analysis seem to have contradictory results.

C. Student Services

Table 5: Survey Results for Student Services

Indicators	NS	S	VS	AWM	D
Tangibles					
Well Ventilated	82	269	49	1.92	S
Spacious	115	254	31	1.79	S
Accessible	73	276	51	1.95	S
Clean and Orderly	55	291	54	2.00	S
Composite Mean				**1.91**	**S**
Reliability					
Processing Time	92	279	29	1.84	S
Accuracy of Records	49	305	46	1.99	S
Always ready to render services to students	66	283	51	1.96	S
Punctuality	68	288	43	1.93	S
Composite Mean				**1.93**	**S**

Responsiveness

	NS	S	VS	AWM	D
Sufficient number of staff to assist you	111	254	35	1.81	S
Queries/Requests are dealt efficiently and promptly	66	301	33	1.92	S
Availability of Channels for expressing student complaints	82	278	40	1.90	S
Provides information/dissemination for services offered and important announcements	69	288	43	1.94	S
Composite Mean				**1.89**	**S**

Empathy

	NS	S	VS	AWM	D
Working for extended hours	102	270	28	1.82	S
Staff are fair and unbiased	74	280	46	1.93	S
Sincere interest in solving students' problem and willingness to help	67	287	46	1.95	S
Staff always approachable	79	273	47	1.92	S
Composite Mean				**1.90**	**S**

Physical Aspect

	NS	S	VS	AWM	D
Well – groomed	42	299	59	2.04	S
Wears appropriate, clean and neat attire	31	293	76	2.11	S
Modulated voice	38	300	62	2.06	S
Pleasing appearance	50	279	71	2.05	S
Composite Mean				**2.07**	**S**
Overall				**1.94**	**S**

Legend:
NS-Not Satisfied, S-Satisfied, VS-Very Satisfied, AWM-Average Weighted Mean, D-Description
Note: 1.00 – 1.66: Not Satisfied, 1.67 – 2.33: Satisfied, 2.34 – 3.00: Very Satisfied

As for the Student Services Office, an overall average of 1.94 was observed, translating to a satisfactory performance. Similar to the previous frontline services, the most satisfactory area is the physical aspect, specifically the wearing of appropriate and clean attire. Possible areas needing improvement are office space (can only hold up to five clients), number of staff (only one person), and working hours (rarely extends beyond office hours) of the staff.

Table 6: Association Rules for Student Services Comments

[Support Word] → [Confidence Words] (Confidence : Value)
[approachable] --> [naman] (confidence: 1.000)
[ayos] --> [lang] (confidence: 1.000)
[mabait] --> [sila] (confidence: 1.000)
[rin] --> [pwede] (confidence: 1.000)
[pwede] --> [rin] (confidence: 1.000)

Accordingly, the analysis of comment data yielded the figures on Table 6. The dominant combinations are "approachable naman" (somewhat approachable), "ayos lang" (somewhat okay), "mabait sila" (they are kind), and "pwede rin" (somewhat okay). The first two and the last combinations signify neutral stances while the third one is a positive stance. Hence, these combinations imply a neutral to satisfactory feedback for the office.

D.Security

Table 7: Survey Results for Security

Indicators	NS	S	VS	AWM	D
Tangibles					
Well Ventilated	176	199	25	1.62	NS
Spacious	148	227	25	1.69	S
Accessible	99	258	43	1.86	S
Clean and Orderly	110	253	37	1.82	S
Composite Mean				**1.75**	**S**
Reliability					
Processing Time	89	272	39	1.88	S
Accuracy of Records	83	278	39	1.89	S
Always ready to render services to students	88	265	47	1.90	S
Punctuality	67	275	58	1.98	S
Composite Mean				**1.91**	**S**
Responsiveness					
Sufficient number of staff to assist you	94	253	53	1.90	S
Queries/Requests are dealt efficiently and promptly	81	277	42	1.90	S
Availability of Channels for expressing student complaints	90	273	37	1.87	S
Provides information/dissemination for services offered and important announcements	89	262	49	1.90	S
Composite Mean				**1.89**	**S**
Empathy					
Working for extended hours	73	228	99	2.07	S
Staff are fair and unbiased	132	226	41	1.77	S
Sincere interest in solving students' problem and willingness to help	86	270	44	1.90	S
Staff always approachable	101	253	46	1.86	S
Composite Mean				**1.90**	**S**

Physical Aspect

	NS	S	VS	AWM	D
Well – groomed	79	269	52	1.93	S
Wears appropriate, clean and neat attire	70	264	66	1.99	S
Modulated voice	91	257	52	1.90	S
Pleasing appearance	86	258	56	1.93	S
Composite Mean				**1.94**	**S**
Overall				**1.88**	**S**

Legend:
NS-Not Satisfied, S-Satisfied, VS-Very Satisfied, AWM-Average Weighted Mean, D-Description
Note: 1.00 – 1.66: Not Satisfied, 1.67 – 2.33: Satisfied, 2.34 – 3.00: Very Satisfied

The security services are observed to be rated satisfactorily by the students as per survey data. The strong point of the frontline service is their physical appearance. On the other side of the spectrum, the weak point is found to be the tangible aspect. As one may notice, a relatively low average is observed on the said area, in fact student perceive problems on the office space (a small room which can contain three persons), cleanliness and orderliness, and the ventilation which is even rated as not satisfactory.

Moreover, a large proportion of the students encounter problems in terms of unequal treatment and even finds the staff not approachable.

Table 8: Association Rules for Security

[Support Word] → [Confidence Words] (Confidence : Value)
[hindi] --> [fair, studyante] (confidence: 0.231)
[minsan] --> [pinipili] (confidence: 0.250)
[minsan] --> [unfair, pinipili] (confidence: 0.250)
[unfair] --> [minsan, pinipili] (confidence: 0.600)
[minsan, unfair] --> [pinipili] (confidence: 0.750)
[pinipili] --> [unfair] (confidence: 1.000)
[unfair, pinipili] --> [minsan] (confidence: 1.000)

With regards to the comment data, the association mining resulted to the extraction of the following dominant terms: "unfair", "pinipili" (selective), "minsan" (sometimes), "hindi fair" (unfair), "studyante" (student), almost all having negative polarity. The word combinations "minsan unfair, pinipili" , "minsan pinipli, unfair", and "hindi fair sa studyante" simply means rules and regulations are imposed by the security personnel selectively.

E. Maintenance

Table 9: Survey Results for Maintenance

Indicators	NS	S	VS	AWM	D
Tangibles					
Well Ventilated	100	267	33	1.83	S

	NS	S	VS	AWM	D
Spacious	87	282	31	1.86	S
Accessible	69	288	43	1.94	S
Clean and Orderly	74	282	44	1.93	S
Composite Mean				**1.89**	**S**
Reliability					
Processing Time	60	295	45	1.96	S
Accuracy of Records	63	296	41	1.95	S
Always ready to render services to students	64	289	47	1.96	S
Punctuality	49	281	70	2.05	S
Composite Mean				**1.98**	**S**
Responsiveness					
Sufficient number of staff to assist you	72	271	57	1.96	S
Queries/Requests are dealt efficiently and promptly	70	281	49	1.95	S
Availability of Channels for expressing student complaints	65	284	51	1.97	S
Provides information/dissemination for services offered and important announcements	74	269	57	1.96	S
Composite Mean				**1.96**	**S**
Empathy					
Working for extended hours	61	271	68	2.02	S
Staff are fair and unbiased	55	282	63	2.02	S
Sincere interest in solving students' problem and willingness to help	55	291	54	2.00	S
Staff always approachable	64	277	59	1.99	S
Composite Mean				**2.01**	**S**
Physical Aspect					
Well – groomed	55	300	45	1.98	S
Wears appropriate, clean and neat attire	42	302	56	2.04	S
Modulated voice	49	295	56	2.02	S
Pleasing appearance	51	291	57	2.01	S
Composite Mean				**2.01**	**S**
Overall				**1.97**	**S**

Legend :
NS-Not Satisfied, S-Satisfied, VS-Very Satisfied, AWM-Average Weighted Mean, D-Description
Note: 1.00 – 1.66: Not Satisfied, 1.67 – 2.33: Satisfied, 2.34 – 3.00: Very Satisfied

For the maintenance personnel, a satisfactory rating is observed. However, unlike the previous services, not only the physical aspect was deemed as the strength of the frontline service but also the empathy aspect. Students in general appreciate the personnel's attire, modulated voice, fair and

equal treatment, and their dedication to work beyond office hours. Interestingly, the most prominent characteristic of the maintenance group can be found in the reliability aspect – their punctuality. These being said, there seems no problem with the maintenance sector except with the status of the ventilation in their area.

Table 10: Association Rules for Maintenance

[Support Word] → [Confidence Words] (Confidence : Value)
[service] --> [naman, yung] (confidence: 0.667)
[service] --> [maayos, yung] (confidence: 0.667)
[service] --> [lang, naman, maayos] (confidence: 0.667)
[service] --> [lang, naman, yung] (confidence: 0.667)
[service] --> [lang, maayos, yung] (confidence: 0.667)
[naman, sila] --> [maayos, magtrabaho] (confidence: 0.667)
[service] --> [naman, maayos, yung] (confidence: 0.667)
[service] --> [lang, naman, maayos, yung] (confidence: 0.667)
[naman, service] --> [lang] (confidence: 0.800)
[maayos, service] --> [lang] (confidence: 0.800)
[naman, service] --> [yung] (confidence: 0.800)
[maayos, service] --> [yung] (confidence: 0.800)

The association rules derived from the comment data for the maintenance sector shows one dominant combination – "maayos naman yung service" which translates into "the service is good". With the extracted high confidence values, it seems like the said phrase appears dominantly in the comment data, thus, implying a generally positive feedback for the sector.

Summary and Comparison

Table 11: Summary of Performance of Frontline Services

Area	Library	Cashier	Student Services	Security	Maintenance
Tangibles	2.09	1.92	1.91	1.75	1.89
Reliability	2.13	1.89	1.93	1.91	1.98
Responsiveness	1.94	1.82	1.89	1.89	1.96
Empathy	1.99	1.85	1.90	1.90	2.01
Physical Aspect	2.22	2.07	2.07	1.94	2.01

Table 11 presents the performance of the different frontline services across the different aspects as per survey data. One may immediately discern that the library outperforms the others in most aspects while the Cashier seems to lag behind the others in majority of the aspects. In terms of tangibles, the library ranks first, followed by the cashier, then the Student

Services and Maintenance personnel. The Security sector badly needed help in this aspect.

In terms of reliability, the Library holds the advantage over the others while improvement can be prioritized for the Cashier's office. Responsiveness seems to be the forte of the Maintenance community while it can be considered as the waterloo of the Cashier staff. Interestingly, the Maintenance unit claims the lead in terms of empathy while the Cashier needs to level up in this aspect. Finally, in terms of physical aspect, the library is the best while worst in this area goes to the security personnel.

Table 12: Summary of Comment Patterns and Sentiments

Office	Comments / Comment Patterns	Sentiment
Library	"tahimik" -> "place" "mga" -> "mababait" **"Kind persons" and "provides a silent place"**	Positive
Cashier Office	"mabagal" -> "process" "mahaba" -> "pila" "bayaran" -> "pila" **"slow" "process" "long queue".**	Negative
Student services	"approachable" -> "naman" "ayos" -> "lang" "mabait" -> "sila" "pwede" -> "rin **"Approachable and kind" / "did not met the desired expectations"**	Positive to Neutral
Security	"hindi" -> "fair", "studyante", "minsan"-> "unfair", "pinipili", "unfair"->"minsan", "pinipili" **"Unfair" or "Unjust"**	Negative
Maintenance	"maayos" -> "naman" "maayos" -> "magtrabaho" "maayos" -> "service" **"Work properly and Good Service"**	Positive

The sentiment analysis based on the comment patterns yielded the final column of Table 12.

Table 13: Comparison of Text Analytics and Numerical Analysis Utilizing Sentiment Analysis

Service	Text Analytics	Sentiment Analysis	Numerical Analysis
Library	tahimik-> place	"quiet place" (+)	tangibles (+)
	mga -> mababait	"kind persons" (+)	empathy (+)
Cashier	mabagal-> process (-)	"slow process" (-)	tangibles (-)

	mahaba -> pila (-)	"long queue" (-)	empathy (-)
Student Services	approachable > naman (neutral)	"quite approachable" (neutral)	empathy (neutral)
	ayos -> lang (neutral)	"quite okay" (neutral)	empathy (neutral)
Security Services	Hindi-> fair (-)	"not fair" (-)	empathy (+)
	unfair -> minsan, pili (-)	"unfair, selective" (-)	empathy (+l)
Maintenance	Maayos-> magtrabaho (+)	"works properly" (+)	empathy (+)
	maayos -> service (+)	"good service" (+)	empathy (+l)

The Library achieved a positive feedback from the clients with the focus on "kindness" and "nature of the place". These coincide with relatively high ratings on the "tangibles" and "empathy" from the survey data.

The Cashier meanwhile acquired a negative feedback as evidenced by the terms "slow", "process", and "long queue". These reflect the problems seen by the student in terms of the tangibles. However, the general sentiment seems to contradict the results of the survey data, this might be due to the fact that the survey questionnaire has been administered to a limited number of students while everybody can access and express their sentiments, especially rants in the social media. It may be also due to the fact that the numerical rating is affected by all aspects while complaints and comments usually focus on the issue(s) being raised.

The Student Services obtained sentiments ranging from neutral to positive. This is an indication that there are aspects the office is good at while there are also significant issues about the service delivery. The result of the sentiment analysis seems to match the output of the survey data – the Student Services Office lies between the worst and best across all aspects.

As for the Security Services, negative sentiments dominate the comments. This is exemplified by the key terms "unjust" and "unfair", validating the observations in the survey data. However, in a similar manner as the Cashier, the general feedback for the security sector as per survey data and sentiment analysis are quite contradictory.

As for the Maintenance sector, both survey data and online feedbacks show one thing – they are good in doing their job. Since empathy seems to be the winning aspect of this frontline service, it is expected that the online comments about them will not be about complaints but commendations rather. The results of the two ways of evaluation are definitely in agreement.

5. CONCLUSIONS

This study focused on the assessment of the proposed evaluation system of Pangasinan State University – Urdaneta City Campus' frontline service performance using two evaluation methods: numerical evaluation based from survey data and text analytics using sentiment analysis of comments gathered from Facebook pages. The following are worth to note:

- Library services are found to be performing satisfactorily using both numerical evaluation and sentiment analysis of comment data. In particular, library services are leading when it comes to the tangibles, reliability, and physical aspects.
- Students are in general satisfied with the service delivery of the Cashier's Office according to the survey data. However, when compared with the other frontline services, it lags behind in terms of reliability, responsiveness, and empathy. Students also found some issues in terms of office space, processing time, and number of staff among others. These issues are validated by the sentiment analysis results, specifically, "long payment queues", and "slow processing". The two methods do not agree in this case, numerical evaluation says "satisfactory" while sentiment analysis provides dominant negative feedbacks.
- In terms of Student Services, students place it between the best and worst cases. This conforms to the sentiment analysis result that the feedbacks are generally neutral to positive. Improvements may be sought specifically in the areas of office space and number of staff.
- With regards to Security Services, the numerical evaluation resulted to a satisfactory rating albeit on the lower spectrum. This low rating is due to unsatisfaction of a relatively large proportion of students particularly on the side of tangibles. Student comments also say that the Security Staff has the tendency to exercise bias.
- For the Maintenance Personnel, they lead in terms of responsiveness and empathy, indicating that they are easiest to get along with as compared to the other frontliners. The sentiment analysis results also state that the maintenance personnel are doing well with job.
- Comparing the numerical evaluation and sentiment analysis, former enables one to pinpoint strengths and weakness. However, since the indicators does not specifically point out the problem, one just usually ends with 'ideas' and 'guesses' on what is the issue. The numerical ratings usually end up as satisfactory since there are aspects which a frontline service excel at. It would be rare for a frontline service to be rated unsatisfactory unless it really fails

in the majority of the aspects. On the other hand, the sentiment analysis is very useful in determining crucial issues that need immediate resolution. It is also very ideal in finding out specific strengths of frontline services. This may be attributed to the fact that comments commonly single out the best or the worst about a service. Usage of both methods tend to complement each other.

REFERENCES

1. A. Ceglar and J. F. Roddick. **Association mining,** *ACM Computing Surveys,* Vol. 38(2), pp. 5-es, July 2006.

2. K. Chakraborty, S. Bhattacharyya, R. Bag and, A.A. Hassanien. **Sentiment analysis on a set of movie reviews using deep earning techniques**, *Social Networks Analytics – Computational Research Methods and Techniques,* pp. 127-147, 2019.

3. O. C. Hansemark and M. Albinson. **Customer satisfaction and retention: the experiences of individual with employees,** *Managing Service Quality,* Vol.14 (1), pp. 40-57, 2004.

4. V. Mckinney, K. Yoon and F. M. Zahedi. **The measurement of web customer satisfaction: an expectation and disconfirmation approach,** *Information System Research Article,* Vol. 13(3), pp. 296-315, 2002.

5. V. M. Ngo. **Measuring customer satisfaction: a literature review,** *Conference: Finance and Performance of Firms in Science, Education and Practice*, 2015, pp. 1638-1655.

6. A .P. Parasuraman, V. A. Zeithaml, and L. L. Berry. **A conceptual model of service quality and its implications for future research,** *The Journal of Marketing,* 1985, Vol. 49, No. 4, pp. 41-50.

7. T. J. Peters. **Individual attention: the key to keeping students in school,** *ACU-1 Bulletin*, pp. 4-8, 1988.

8. N. Rudge. **Examining student satisfaction with the student services center at a local community college,** Counselor education master's thesis, 2014.

9. O. Llanera. **Level of student satisfaction on the frontline services of Capsu Satellite College,** *International Journal of Scientific and Research Publication,* Vol. 6, June 2016.

10. N. Zakaria, R. Umar, W. H. A. W. Deraman, and S. S. S. A. Mutalib. **Regression analysis on factors influencing students' satisfaction towards program courses,** *Indian Journal of Science and Technology,* Vol. 9(17), 2016.

11. S. Thomas. **What drives student loyalty in universities: an empirical model from India,** *International Business Research,* 2011, Vol. 4(2), 183-192.

12. https://www.incite-group.com/customer-experience /has-social-media-increased-levels-customer-satisfa ction (accessed August 11, 2020).

13. F. Duodu and T. Amankwah. **An analysis and assessment of customer satisfaction with service quality in insurance industry in Ghana**, Master's thesis, Dept. of Business Administration, Technology and Social Sciences, Luleå Univ. of Technology, Luleå , Sweden, 2012.

14. M. S. Krishnan, V. Ramaswamy, M. C. Meyer, and P. Damien. **Customer satisfaction for financial services: the role of products, services, and information technology,** *Management Science, Vol. 45(9):1194-1209, 1999.*

15. L. Grnholdt and A. Martensen. **Analyzing customer satisfaction data: a comparison of regression and artificial neural networks,** *International Journal of Market Research,* Vol. 47(2), pp. 121-130, *2005.*

16. S. Ibidunni, O. M. Ibidunni, O. A. Oluremi, and A. W. Ayeni. **Examining the relationship between tacit knowledge of individuals and customer satisfaction,** *Academy of Entrepreneurship Journal,* Vol. 24(1), March *2018.*

17. K. Menon and L. Dubé. **Ensuring greater satisfaction by engineering salesperson response to customer emotions,** *Journal of Retailing,* Vol. 76(3), pp. 285-307, July *2000.*

18. S. A. Porter. **Information technology manager's perspective on experiences with service quality and customer satisfaction: a phenomenology study,** DM/IST dissertation, University of Phoenix, *2016.*

19. Z. Xiang, Z. Schwartz, J. H. Gerdes Jr., and M. Uysal. **What can big data and text analytics tell us about hotel guest experience and satisfaction?,** *International Journal of Hospitality and Management,* Vol. 44, pp. 120 – 130, January *2015.*

20. X. Xu and Y. Li. **The antecedents of customer satisfaction and dissatisfaction toward various types of hotels: a text mining approach**, *International Journal of Hospitality and Management,* Vol. 55, pp. 57-69, May 2016.

21. N. Hu, T. Zhang, B. Gao, and I. Bose. **What do hotel customers complain about? text analysis using structural top,** *Tourism Management,* Vol. 72, pp. 417-426, Jan. 2019.

22. W. M. K. K. Karunaratne and L. N. A. C. Jayawardena. **Assessment of customer satisfaction in a five star hotel – a case study,** *Tropical*

Agricultural Research, Vol. 21(3), pp. 258 – 365, 2010.

23. A. Minu and U. Kumar Reddy, **Feature based sentiment analysis of mobile product reviews using machine learning techniques.** *International Journal* 9.2 (2020).

24. M.V., Buladaco, J. Buladaco , L. Cantero. **Sentiments analysis on public land transport infrastructure in davao region using machine learning algorithms.** *International Journal* 9.1 (2020).