

Sentiment Analysis of the Academic Services of ESSU Salcedo Campus using Plutchik Model And Latent Dirichlet Allocation Algorithm

Hershey R. Albuero, Cherry Lyn C. Sta. Romana, Larmie S. Feliscuzo



Abstract: *The continuous pursuit of quality education has always been a concern of higher institutions. This can be seen in the way university teachers deliver academic services to the students in terms of professionalism, commitment, knowledge of the subject matter, teaching for independent learning, and management of learning. Students as recipients of these services are significant sources of information about their course interaction that takes place in an educational system. Utilizing Latent Dirichlet Allocation (LDA) algorithm and sentiment analysis through NRC emotion lexicons based on Plutchik Model, this study aimed to decipher students' sentiments of the academic services and reveal commonalities contained in their qualitative responses. Results revealed five latent themes in the students' responses as: The Disparity of Teaching Assignment to Professors Field of Expertise, Professors' Expression of Willingness to Help Students in School-Related Matters, Desirable Traits Portrayed by a Professional Teacher, Professor's Commitment and Dedication to Classroom Instruction, and Enhancement of Teaching Practices to Improve Quality of Academic Services. The results also suggest that majority of the students have a positive sentiments (64.42%), some of were negative (34.62%), and very few were neutral (0.95%). This study aimed to give inputs to any academic interventions undertaken by institution.*

Keywords: LDA, Sentiment Analysis, Plutchik, Academic Services, ESSU Salcedo, Philippines

I. INTRODUCTION

One of the pressing concerns in higher education institutions is the enormous amount of academic data and in finding ways to use them to improve the delivery of the academic programs and services and thereby enhance managerial decisions¹. These data are products of the interaction between the students and the university teachers contained in an educational system that could be a traditional classroom or a web-based educational system. The primary function of university faculty is to provide quality academic services to the students where Sembering², believed that faculty performance can strongly affect levels of satisfaction and dissatisfaction of students and will eventually influence

their success or failure in learning. In this paper, the academic services are referred to as how professors display professionalism, how they show commitment, how they exhibit knowledge of the subject matter, how they teach students to be independent learners, and how they manage learning opportunities in the classroom³. While most institutions rely on numbers and charts to analyze data, it lacks the ability to reveal hidden information⁴. In a state-owned university, surveying students responses related to instructors performance is limited to a questionnaire distributed per semester. However, students, considered as the heart of the university, are rich sources of information about how they actually feel in their learning environment, their satisfaction of the course, the methods of instruction, and their total assessment as a student in that university. Considering the opinions of students through sentiment analysis is an important base in the decision-making of the academic institution under study. Opinions are the heart of all human activities and are key influencers of human behaviors. Opinions, sentiments, evaluations, attitudes, and emotions are subjects of study of sentiment analysis and opinion mining. Sentiment analysis analyses people's opinions, sentiments, evaluations, appraisals, attitudes, and emotions towards entities such as products, services, organizations, individuals, issues, events and their attributes⁵. Sentiment analysis coupled with the applications of Latent Dirichlet Allocation in the academe has grown from understanding students' learning practices⁶, analyzing journals of preservice teachers⁷, up to extracting students written responses of teacher leadership dilemma⁸. In this research, views and opinions of college students about the academic services of a state university were collected to decipher their unified thoughts as well as the hidden meaning in their responses. The identification of semantic contents in a corpus increases people's understanding on what it addresses, the characteristics of that corpus, and the interplay between each topics contained in that corpus⁹. It is on this premise that this study utilized Latent Dirichlet Allocation algorithm and Plutchik wheel of emotions model to extract meaningfully various sentiments, thoughts, and written expressions from the students regarding the quality of the academic services provided by the university to serve as significant inputs in any academic intervention.

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II. RESEARCH METHODS

A. Research Design

This research followed a *sequential exploratory mixed methods* design using a corpus of students' responses. This is a two-phase design, quantitative and qualitative, in which in the initial phase, data were collected using qualitative analysis, followed by quantitative data generation was employed with a concluding stage of data analysis combining the two results^{10,11}.

To provide answer to the research questions, this study used content analysis using relational analysis and was strengthened by exploring the concepts preselected by the researcher. Relational analysis is also labeled as semantic analysis¹². This research also followed logical steps in the qualitative data collection from the student-participants, data processing, and themes development. Interpretation of hidden information in the text corpus was done through themes validation¹³.

B. Research Process and Data Analysis

This study utilized the web mining processes to provide answers to the research questions:

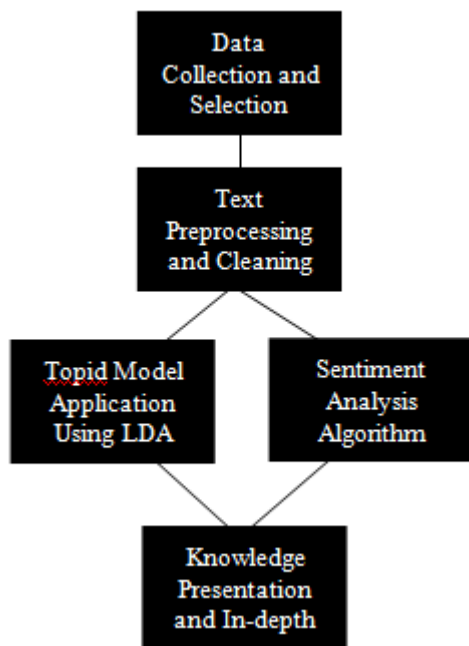


Fig. 1. Fig. 1. The Research Process.

Data Collection Procedure. This is the first process done in this research wherein a 4-page interview guide was distributed to college students with at least 2 years residency in a state university in Eastern Samar, Philippines. The said criteria is set to increase reliability and validity of the responses. Before distribution, the said questionnaire which contained open-ended questions, was edited and evaluated by a senior qualitative researcher in the university.

After which, a group interview was conducted to validate their responses. The students are from the three (3) colleges of the state university namely: College of Information and Communication Technology (CICT), College of Education (COED), and College of Agriculture and Allied Sciences (CAAS). A total of 130 student responses were collected.

Text Pre-processing and Cleaning. Text mining is a procedure of taking out vital information from large amount of data¹³; In text mining and Natural Language Processing, pre-processing and information retrieval is an important task and critical step since this is the stage where data preprocessing is used for extracting interesting and hidden knowledge from unstructured text also known as corpus. The pre-processing and cleaning methods performed in this research are:

English Stopwords Removal: This research removed English stopwords from the corpus that do not have direct relevance in the sentences. These are words that is considered as a connecting function in the sentence, such as articles, prepositions, and others¹⁴. These words may also have high frequency of occurrence in the documents which are not related to a query as in those documents relevant to a query, such as “at”, “the”, “which”, “is”, and “on”¹⁵. In cleaning the data, these words were removed before applying any text processing techniques affect which will not influence the final sentiment score of the sentence.

Stemming Method: Stemming is a procedure of replacing words with their stem or root. The dimensionality of the Text-Bag of Bag-of Words representation is reduced when a root-related words such as “profession”, “professional”, “professionalism”, are all can be stemmed to the word “profession”, which in turn will decrease the processing time of the final output^{13,14}. This research used *N-Gram Stemmer* as it is language independent and hence very useful in many applications¹³. An N-Gram is an N-character slice of a long string¹⁵.

Term Frequency-Inverse Document Frequency (TF-IDF): Term Frequency-Inverse Document Frequency (TF-IDF) is a numerical statistic that reveals how important a word is in a collection of documents. Dividing the term frequencies by document frequencies to lower the weight of those words common across all documents is the work of the TF-IDF^{13,14}. Term Frequency (TF) indicates the number of occurrence of a term in a document. In R-programming language, the result is expected to constructs a document-term matrix or a term-document matrix^{13,16}.

Other pre-processing techniques used in this research include:

- Stripping White Spaces
- Transforming contents to lower case
- Removing of all punctuations, symbols, numbers, and other characters

C. Topic Modeling using Unsupervised Learning

Student satisfaction is a multifaceted process that entails more than potential identification of what they want from the university to achieve better academic services. Understanding sentiments of the students can also be enhanced by identifying or unfolding hidden topics contained in their written and verbal responses. In machine learning and natural language processing, topic modeling methods are used for automatic organization, understanding, searching, and summarizing large electronic files¹⁷. It is widely used to examine thematic composition of text corpora that is difficult to interpret and adjust.



Topic modeling finds human-readable structures in unstructured textual data, and one of the most extensively used technique is the *Latent Dirichlet Allocation (LDA)*¹³.

This research utilized *Latent Dirichlet Allocation (LDA)* to analyze and explore topics over a document collected from a number of students talking about their professors' delivery of the academic services. Consistent to the assumption of bag-of-words, LDA represents a document as a mixture of potential topics in which a topic has a multinomial distribution over words. Every document will have its mixing proportion of topics and its topic has its word distribution^{13,18}.

Based on an unsupervised Bayesian learning algorithm, LDA captures the potential topics that represents the students' sentiments contained in their responses¹⁹.

With LDA, one can identify the maximum number of topics, label the topics, and analyze the differences and relative importance of the topics for different text corpus¹⁸. LDA is a three-layer Bayesian probability model and a complete generative model of a document. A graphical representation (Figure 2) is adopted from Blei, Ng, and Jordan²⁰ where the basic idea states that a document represents a random concoctions over possible topics, where categorization of each topic is represented by a distribution of words¹⁹.

Figure 3 represents plane notation, the dependencies among many variables bagged concisely. The boxes are "plates" representing duplicates. The external plate represents the collective choice of topics and words in a document. M denotes the number of documents and N the number of words in the document¹⁹. Thus:

α is the parameter of the Dirichlet prior on the per-document topic distributions
 β is the parameter of the Dirichlet prior on the per-topic word distribution
 θ_m is the topic distribution for document m
 ϕ_k is the word distributed for the k
 z_{nm} is the topic for the n th word in document m
 w_{nm} is the specific word.

The w_{ij} are the only observable variables and the other variables are latent variables. In most cases, the basic LDA model is extended to a smoothed version to gain better results. The plane notation is shown in Figure 3 where K denotes the number of topics considered in the model and is a $K * V$ (V is the dimension of the vocabulary) Markov matrix (transition matrix) and each row of denotes the word distribution.

The generative process algorithm:

- 1 Choose $\theta_i \sim Dir(\alpha)$ where $i \in \{1, \dots, M\}$ and $Dir(\alpha)$ is the Dirichlet distribution for parameter α
- 2 Choose $\phi_k \sim Dir(\beta)$ where $k \in \{1, \dots, K\}$
- 3 For each of the word position i, j , where $j \in \{1, \dots, N_i\}$ and $i \in \{1, \dots, M\}$
 - a Choose a topic $z_{ij} \sim Multinomial(\theta_i)$
 - b Choose a word $w_{ij} \sim Multinomial(\phi_{z_{ij}})$

The exact parameter inference of the LDA is difficult, and thus, approximate estimation methods are needed. An appropriate algorithm named Gibbs Sampling^{18,19} is widely used for parameter estimation in topic models due to its simplicity under Dirichlet priors.

```
Initialize  $x^{(0)} \sim q(x)$ 
for iteration  $i=1, 2, \dots$  do  $x^{(i)} \sim p(X_1 = x_1 | X_2 = x_2^{(i-1)}, X_3 = x_3^{(i-1)}, \dots, X_D = x_D^{(i-1)})$ 
 $x_2^{(i)} \sim p(X_2 = x_2 | X_1 = x_1^{(i)}, X_3 = x_3^{(i-1)}, \dots, X_D = x_D^{(i-1)})$ 
.
.
.
 $x_D^{(i)} \sim p(X_D = x_D | X_1 = x_1^{(i)}, X_2 = x_2^{(i)}, \dots, X_{D-1} = x_{D-1}^{(i)})$ 
end for
```

Figure 2: Gibbs Sampler General Algorithm

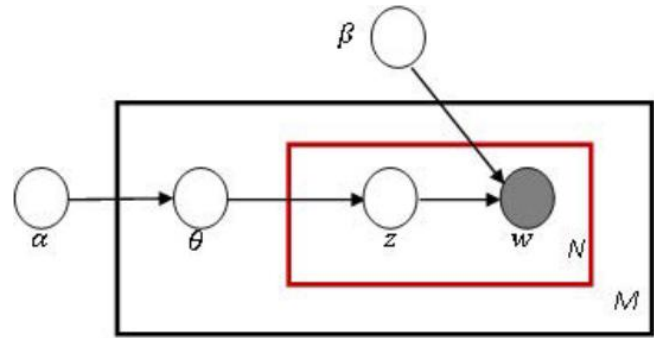


Figure 3: Plane Notation representing LDA

Gibbs Sampling Method – MCMC Approach for Validation. One of the Monte Carlo Markov Chain (MCMC) technique appropriate in this research is Gibbs Sampling Method where the basic idea is to generate subsequent samples by sweeping through each variable (or block of variables) to sample from its conditional distribution with the remaining variables fixed to their current values²² as in Figure 2. The fundamental concept of MCMC sampling is that we can estimate any desired expectation by ergodic averages. That is, we can compute any statistic of a posterior distribution as long as we have N simulated samples from that distribution^{19,22}. This procedure keeps on until the sample values have the same distribution as if they were ample for the right posterior joint distribution called "convergence"¹⁵.

D. Sentiment Analysis

Sentiment analysis is fundamentally a text classification problem where it identifies and extracts subjective information from a collection of materials and helped to see social and general persuasion of a particular event¹³. In this research, discovering sentiments of the students regarding the traits of the professors when doing classroom instructions are deciphered using two distinctive sentiment algorithms such as **Plutchik Wheel of Emotions** and the **NRC Word-Emotion Association Lexicon**²³

Plutchik Wheel of Emotions Model

Sentiment classification using traditional methods mainly classifies documents as positive, negative, and neutral. With Plutchik's emotional wheel the emotion is more specifically categorized into eight fundamental emotions such as joy and sadness, anger and fear, trust and disgust, and surprise and anticipation¹⁴. Moreover, Plutchik's model shows connectivity between the ideas of an emotion circle with a color wheel (Figure 4). The eight emotions are said to be complete since any expressed emotion is related or subsumed by one of the eight emotions. Plutchik revealed that these emotions are culturally and ethnically independent, thus considered appropriate in this research since we can apply this to any given language²⁵.

NRC Word-Emotion Association Lexicon

To reinforce the idea of the Plutchik Wheel of Emotions model, this study utilized the NRC Word-Emotion Association lexicon²⁴ since it encompasses a list of English words and their associations with Plutchik's eight basic emotions added with two sentiments classified as negative and positive. It involves three variables:



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1. **TargetWord** – this is a word for which emotion associations are provided²⁴.
2. **AffectCategory** – this refers to the eight emotions with the two sentiments (negative and positive)²⁴.
3. **AssociationFlag** – has one of the two possible values: 0 or 1; where 0 indicates that the target word has no association with affect category, whereas 1 indicates association.²⁴

This list of emotion lexicons enhanced the meaning of the sentiments like in this case - the students sentiments of their professors towards the academic services.

E. Interpretation

This is the final stage of data mining where knowledge generation based on the interpretation of the researchers is being done. The interpretation of this research is based on the theoretical and philosophical of the themes and values generated from the results. Expert reviews, observation notes, and semi-structured interview were considered to provide a triangulated perspective. In-depth articulations of the findings were also made in presenting the analysis part.

In carrying out this research, and in finding answers to the research questions, this study utilized two methods called the Latent Dirichlet Allocation (LDA) Algorithm and Sentiment Analysis using the NRC Word-Emotion Lexicon Association based on Plutchik's Wheel of Emotion Model. LDA through Gibbs Sampling – Monte Carlo Markov Chain (MCMC) was used to reveal hidden themes and patterns contained in the students' responses while the sentiment analysis part was applied in extracting emotions from the corpus. Following Plutchik's Model, it aims to capture eight (8) basic emotions such as: anger, anticipation, joy, fear, trust, sadness, surprise and disgust.

F. Tools and Software Used

This research utilized Python and R programming languages for data visualization and interpreting mathematical equations.

G. Ethical Considerations and Reflexivity

This paper adheres to all ethical mandates in conducting research. This was first presented to the institutional research committee to gather suggestions and recommendations before data gathering commenced. A researcher-made interview guide was also presented to an expert in qualitative research for his review and revision. Before conducting the interview, the participants were oriented as to what their responsibilities are and were guaranteed anonymity and confidentiality of their responses. Since the researcher is a faculty teaching in the university, her experiences may affect her interpretations of the themes, which is also biased to her knowledge, and personal observations of the learning environment.

III. RESULTS AND DISCUSSION

A. Latent Themes about the Academic Service

The data collected from students responses were transcribed using LDA algorithm. As in Table 1, each document was given a particular topic that LDA found. Same topic number indicates common stories or underlying themes such as document (CAAS-101 & CAAS-69) were auto assigned to topic one (1). Very common documents appeared as topic seven (7), like CAAS-56, CAAS-57, CAAS-60 to CAAS-65.

Table I. Text to Topic Assignment

Responses	Topics
CAAS-100.txt	2
CAAS-101.txt	1
CAAS-102.txt	8
CAAS-56.txt	7
CAAS-57.txt	7
CAAS-58.txt	10
CAAS-59.txt	8
CAAS-60.txt	7
CAAS-61.txt	7
CAAS-62.txt	7
CAAS-63.txt	7
CAAS-64.txt	7
CAAS-65.txt	7
CAAS-66.txt	6
CAAS-67.txt	10
CAAS-68.txt	8
CAAS-69.txt	1
CAAS-71.txt	2
CAAS-72.txt	7

Theme 1. The Disparity of Teaching Assignment to Professors Field of Expertise

In the context of Economics, it is commonly accepted that specialization maximizes productivity. In education, success is determined by qualification of faculty working in an institution. The quality of education is directly related to the quality of instructional services provided in the classrooms. Knowledge of the subject matter, strong academic qualifications, skills and competence of teaching and commitment of teachers has strong influence on the teaching and learning processes²⁵. Teaching within areas of specialization is also associated to students' satisfaction. Butt and Rehman²⁶ found that overall impression of the school and the quality of education, teachers' expertise and interest of the subject matter were some of the most significant predictors of student satisfaction.

This implies that even a highly qualified teacher can become low performer when assigned to teach subject which they have no or little background. In the case of the state university under study, the students are expecting that professors will be assigned to teach subjects within their areas of specialization so they could deliver complex and complicated matter effectively, helping students attain mastery of the course contents.

Table II. Topic to Terms and Generation of Latent Terms

Texts	Topic1	Topic2	Topic3	Topic4	Topic5
1	subject	students	good	materia ls	Learnin g
2	matter	professor s	class	profess ors	Acade mic
3	knowle dge	learn	important	time	Service s
4	professi onalism	help	approach able	class	Comm itment
5	independ ent	understan d	use	prepare d	Show
6	learnin g	group	assist	ready	Want
7	suggest	well	happy	teach	Teach



8	regularly	works	study	giving	Opportunities
9	commitment	grades	professionalism	want	Management
10	management	school-related	need	commitment	university
11	display	explain	always	however	improvement
12	exhibit	aspect	characteristics	instructional	teaching
13	different	willing	make	works	subject
14	school	continue	tools	dismiss	provide
15	assigned	topics	best	test	quality
16	important	activities	instructional	others	beyond
17	mastery	attend	clarity	work	participate
18	classes	related	using	coming	allowing
19	expertise	show	practice	period	discussing
20	satisfied	share	management	classmates	late
Underlying Themes	The Disparity of Teaching Assignment to Professors Field of Expertise	Professors' Expression of Willingness to Help Students in School-Related Matters	Desirable Traits Portrayed by a Professional Teacher	Professor's Commitment and Dedication to Classroom Instruction	Enhancement of Teaching Practices to Improve Quality of Academic Services

Theme 2: Professors' Expression of Willingness to Help Students in School-Related Matters

A student is more motivated to learn if he knows that teachers are ready and willing to help him go through the academic demands. A student, who has a stable connection to her teacher, constantly communicate with her, receives more constructive guidance and praise rather than criticism will show high engagement in learning, and achieve higher levels academically²⁷.

There is also a feel of belongingness in school which refers to the degree in which students feel respected, accepted, and supported by teachers and peers²⁸. When students feel they belong, they are more likely to gain confidence in seeking help from their professors when the course demands for it. He also mentioned that at-risk students should be taken with utmost consideration since they are the ones who needs help the most.

The students in the study expressed satisfaction and have positive experience with their professors related to their willingness to assist them in matters concerning school even beyond official teaching hours.

Theme 3: Desirable Traits Portrayed by a Professional Teacher

Great teachers develop great students. One characteristic of being professional is being an appropriate role model of adulthood. Behaviors and language of university teachers are always at the forefront, and it is appropriate to speak that they are models to the students in terms of professional boundaries, ethical responsibilities and a solid work effort²⁹.

In this research, the students expressed delight about the professionalism of their teachers by attending classes regularly and on time, coming to class ready and prepared with instructional materials, and dismissing the class on time. However, a number of students related that not all of their professors display this kind of professionalism. They also want proper notification when a certain professor will be absent from their class so they can save time waiting for him/her.

Theme 4: Professor's Commitment and Dedication to Classroom Instruction

A competent and committed teacher is one indicator of success in any educational system. A truly committed teacher puts students' learning and interests above everything else³⁰. When a teacher is passionate and dedicated they create an effective learning environment and increase learning potential of students. Kushman (1992) and Rosenholtz (1989) in their studies speaks on the relationship between teacher commitment and student achievement. In support with this idea, Fried (2001) stated that there is high correlation between passionate teaching and the quality of student learning³¹. Another factor that contributes to teachers' commitment and dedication is in the implementation of administrative policies and support. Compatible administrative implementation strengthens teachers' commitment. The desire of teachers to spend more time at school, make more effort for school achievement, and approve compatibility of administration are among contributing causes of commitment and dedication to school³¹.

In line with this assumption, students desire for passionate and dedicated teachers who strive to establish learning environment where they can have opportunities to learn from their mistakes, an environment where they will not be scared of asking questions, and an environment where they are inspired and motivated to learn.

Theme 5: Enhancement of Teaching Practices to Improve Quality of Academic Services

Research claims that quality teaching should always be student-centered because it aims to help most students in their learning development. Teachers might change their teaching practices when they reflect upon the students and engage themselves in examining their own theories of teaching practices in the classroom³². However, the truth is that they do not have time to reflect on their daily teaching practices that may lead to improvement, or they are not aware of this process. Most teachers believe that delivering the planned lessons on that specific day and time is the necessity, neglecting the fact and being least bothered about knowing if the student learned the lesson or about evaluating if the student grasp the even the basic concept of the lesson³².



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There are five variables of teacher's effectiveness³³ – variability, clarity, task-oriented, enthusiasm, and the students' opportunity to learn school materials. However, personal and professional traits of teachers are also known to be effective criteria. Being reflective, showing empathy, respecting students, being a good communicator, his own passion for learning, as well as his instructional delivery makes a teacher effective³³.

With the passage of time, research has been centered on the enhancement of teaching practices in which students also expect from the educators. As mature learners, students of the state university, long for teachers who will not only tell their personal stories not related to the subject, but should also enhance their logical and analytical thinking through proper instructional materials, and educate them to be life-long learners.

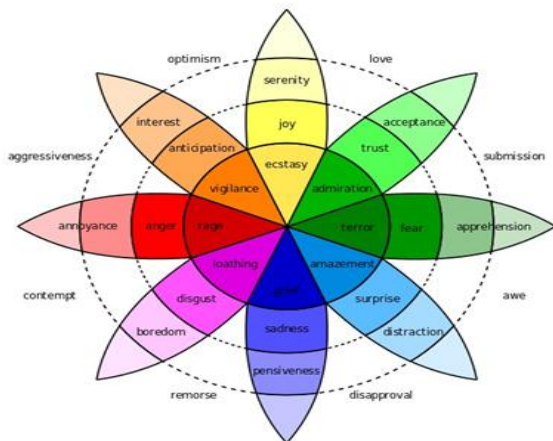


Figure 4. Plutchik Wheel of Emotions Model

B. Students' Sentiments on the Academic Services

It is interesting to note that the greatest number of sentiment scores of the students' responses (Figure 5) towards the demonstration of the academic services of their professors is positive sentiments. It garnered 64.42% where happy, good, approachable, important, prepared, and teach were the most noticeable terms. In contrast, 34.62% were negative sentiments with late, sad, dismiss, use, teaching terms were depicted. Other terms were considered neutral by the algorithm. To further understand the sentiments, students' sentiments portraying different emotions were processed utilizing Plutchik's wheel of emotions. Trust accounts the around 1,800 words, followed by Anticipation with 900 words, then Joy with 700 words, followed by Surprise with 300 words, then Fear and Anger with around 200 words, and disgust with 100 words.

Table III. Text to Topic Probabilities of Latent Themes

Texts	Topic1	Topic2	Topic3	Topic4	Topic5
1	0.1299	0.0960	0.1921	0.0847	0.0791
2	0.6166	0.0822	0.0959	0.0890	0.6160
3	0.4771	0.0805	0.0872	0.0537	0.1812
4	0.1563	0.5081	0.0820	0.4145	0.1328
5	0.2037	0.5786	0.7414	0.1358	0.1173
6	0.1058	0.0288	0.1314	0.1699	0.1058
7	0.1185	0.6064	0.1185	0.0948	0.1848
8	0.1667	0.0965	0.0746	0.0921	0.1404
9	0.2381	0.0476	0.1286	0.1238	0.1238
10	0.1963	0.0731	0.0913	0.8681	0.0320

11	0.1754	0.0643	0.0994	0.1520	0.0936
12	0.6532	0.0785	0.4960	0.1322	0.1240
13	0.1553	0.0680	0.0437	0.7870	0.0922
14	0.1182	0.0887	0.0542	0.1232	0.6261
15	0.1519	0.5060	0.0591	0.2996	0.5910
16	0.6372	0.0643	0.6435	0.1053	0.1696
17	0.1327	0.0663	0.0969	0.1173	0.1122
18	0.0951	0.0951	0.1445	0.0760	0.1179
19	0.2094	0.1152	0.0471	0.6284	0.1309
20	0.1818	0.0455	0.7950	0.0682	0.1534
Underlying Themes	The Disparity of Teaching Assignment to Professors Field of Expertise	Professors' Expression of Willingness to Help Students in School-Related Matters	Desirable Traits Portrayed by a Professional Teacher	Professor's Commitment and Dedication to Classroom Instruction	Enhancement of Teaching Practices to Improve Quality of Academic Services

The results from the sentiment analysis imply that the professors are approachable, prepared and ready in coming to their classes. They are doing the best as professional teachers worthy in a university. However, many are expecting that the university faculty should be on time to their classes, and should give emphasis on teaching for independent learning. Thus, it is important to listen to the sentiments and emotions of the students prior to any academic interventions, for they are the most important resource in a university.

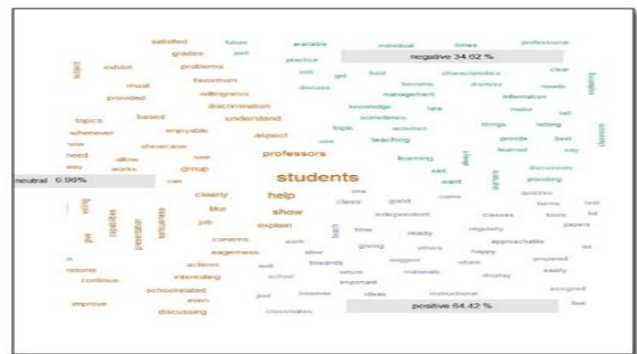


Figure 5. Students' Sentiments on the Academic Services

Figure 6 shows top 16 of the most frequently appearing words in the corpus. It is obvious that the students are talking about their professors and their subjects as both have the most number of occurrence.

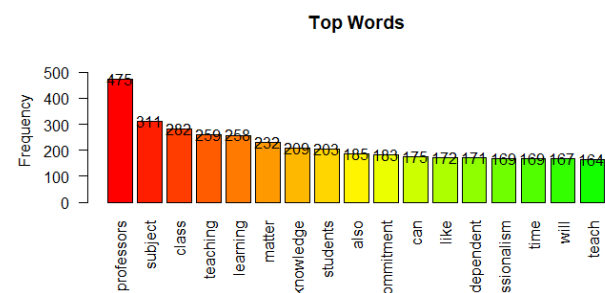


Figure 6. Frequent Words in the Corpus

The word cloud in figure 7 portrays the emotions of the students towards their professors. The bag-of-words are divided into 8 based on Plutchik wheel of emotions with a concluding negative and positive emotions.



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