

Mining Opinions from University Students' Feedback using Text Analytics

Angela S.H. Lee

Department of Computing and Information Systems
Faculty of Science and Technology, Sunway University
5 Jalan Universiti, Bandar Sunway
Selangor, Malaysia

Tong-Ming Lim

Department of Computing and Information Systems
Faculty of Science and Technology, Sunway University
5 Jalan Universiti, Bandar Sunway
Selangor, Malaysia

Abstract— Feedback from university students on their experience while studying in any university allows an institute of higher learning to strategize and improve their strategies in order to enrich students' university experiences. In Malaysia, a yearly student survey is conducted to solicit feedback and this research studies the feedback by using text analytics to analyze issues in the form of key terms that were discussed in the feedback among these students. The outcomes of the analysis in this paper will highlight key topics and related sub-topics in their feedback. Another outcome of the analysis highlights clusters of feedback where themes that are closely interrelated will be put into the same cluster. The unstructured feedback in this research analyzes their arrival to the university, learning activities and living experiences. The methodology used in this research entails review of related works, understanding on the importance of student experience, text analysis that consists of text parsing, filtering, and topics and clustering of themes after texts are pre-processed, and finally analyzing the outcomes produced. This paper concludes by drawing several issues to the attention of the institute.

Keywords—concept map; text analytics; text cluster; text topics; university experience

I. INTRODUCTION

The importance to listen to what students have to say in any institute of higher learning is undeniable. Students express themselves in many forms. Some pour out their unhappiness and dissatisfaction on social media platforms such as Facebook and Twitter. Some choose to file their complaints to the administrators of the universities. In many cases, students do not speak about it. As a result, universities carry out survey periodically to collect their feedback and analyze them in order to listen to their voices. Their voices in the form of unstructured text are analyzed in order to provide inputs to planners when strategies are drafted, revised and planned.

Some past research has provided evidence with respect to the research topic in this paper. For example, a study was conducted to examine the theoretical framework to understand the international student's expectations where they regard it as consumer satisfaction during their tenure years in the university [1]. The objectives of this study are to understand the students' satisfactions based on the diversity of geographical, nationality and programmed enrolled. It is important to know students' expectations during their course of study with the university. It

was said that among the expectations some of the most popular discussions from most students are the university reputation, quality of education, facilities and services provided to them. When all these expectations are met, students' level of loyalty towards their institution increases.

II. RELATED WORKS

This section reviews past related works. Several papers were reviewed on student experience in higher institutions research in the first part of this section. This is followed by reviewing works on application of text analytics in industries. In the work carried out by [2], they stressed that real-time constructive assessment of student learning experience gained a lot of attention between academician and researchers. Students' textual responses offer a rich source of data. However, to analyze textual responses automatically poses significant challenges where the difficulty of churning out accurate assessments based on student's writing is time consuming due to volume is large and organization of unstructured text is complex if analyze manually. Riding on the benefit of text analytics, students' text responses can be analyzed accurately in a short time. A hybrid text analytics method called WRITEEVAL was introduced by these researchers to analyze students' responses in their work. Outcome of their study has highlighted that analysis using WRITEEVAL on written responses by fourth graders are accurate. In a study that Ferguson and Shum [3] carried out pointed that web analytics tends to focus on quantitative data whereas learning analytics focus on qualitative understanding of the information. Their study investigated sociocultural analysis to understand synchronous text conversation through chat during real time conference. Phrases and key words identified in these conversations were found at the peaks of the conversation associated with periods set aside for keynote speakers. Therefore, the outcome of their study benefits learners and teachers in conversational chat within the university.

On the other hand, Blikstein [4] studied automated technique that assesses, analyzes, and visualizes students' learning activity in a computer programming class. Several students' codes were extracted from hundreds of snapshots of their codes during a programming assignment, and different quantitative techniques were used to extract students' behaviors

and categorize them in terms of programming experience. The analysis process consists of review of related literature on educational data mining, learning analytics, computer vision applied to assessment, and emotion detection, discuss the relevance of the work, and finally describe one case study with a group undergraduate engineering students.

The following few papers examine related text mining technologies and their applications. Fan, Wallace, Rich and Zhang [5] discussed text mining technologies which includes information extraction, topic tracking, summarization, categorization, clustering, concept linkage, information visualization and question answering. They provided brief discussion on each type of mining technology in their paper. Information extraction analyzes unstructured text and identifying key phrases and relationships within text using a set of predefined sequence of text. This give meaningful information for large volume of text through relationships of these text. Topic tracking system, on the other hand, keeps user profiles based on the document a user views and predicts other documents of interest to the user. It can be used to alert a company on news regarding competitor in the news. Text summarization summarizes a lengthy document whether this document meets the user's needs. However, the challenge is the software finds it difficult to analyze semantics and meaning of a piece of text accurately. Categorization identifies the main theme of a document by counting words in the document that appear where the software relies on the thesaurus for which the topics are predefined and relationships identified by examining broad terms, narrower terms and synonyms. Clustering groups similar documents on the fly without using predefined topics. A document may appear in multiple topics. This allows all the documents to be classified to different topics. Concept linkage connects related documents using shared concepts. This approach helps browsing relevant documents by different concept. Concept linking relates relevant documents of a concept effectively. Information visualization put large textual sources in a visual platform to provide browsing capabilities. For example, police use visualization to identify terrorist networks to find information about crimes that are either connected or unconnected. The last systems in the text mining technology is question answering system. This system provides natural language queries or question answering capability that deals with finding the best answer for a given question. Each of these technologies has been deployed in different type applications for different purposes. In the paper published by Grobelnik, Mladenic and Jermol [6], they used CRISP data mining methodology in their work to investigate five potential customers on different text mining problems. One of them was found to have a well-defined set of text mining challenges where the project entails activities such as taxonomy/ontology building from a large set of documents, searching the database, and solving non-English language issues. Out of the five (5) potential projects, this project has been successfully completed using text mining technique. In the work carried out by Gamon, Aue, Corston-Oliver and Ringger [7], they discussed a prototype system that is used to mine topics and sentiment orientation of customer feedback in the form of free text. They tested the system on a database of car reviews and it was found that it is capable to explore large quantities of customer free

text on their opinion at a glance or at a finer level of detail. Techniques they deployed involved clustering and bootstrapping approach to sentiment classification where these techniques analyze at the sentence level instead of document level. Their project has been found to be successful and have achieved their objective.

These few papers provide a sneak preview on how text mining technologies a able to extract key concerns, complaints, words of complement, root cause of concerns and build a useful network of related key issues to the business operators in order to make plan in their business strategies.

III. PROBLEM STATEMENT

Due to many complaints received by Ministry of Education from both Malaysian and international students, hence the ministry has enforced student experience survey for all the universities as a yearly compulsory exercise [8, 9]. However, due to skill, expertise and resources constraints faced by these universities and the ministry, hence these comments and feedback were not analyzed at all. In some cases, the analysis has only been presented in the form of report or simplistic graphs such as frequency histograms. Considering the amount of unstructured text that one needs to read and analyze, it is not efficient and productive. This research focus on feedback from students when they arrive at a university, their learning experience in the university, and lastly their experience as a student living close to the university. The problems were derived from complaint received from students whether they are local or international students in a private local university.

IV. OBJECTIVES

The objective of this research is to analyze the feedback from all the students in a university to highlight their key concerns through the key terms in their feedback using text mining method. From the analysis of these key terms, important issues can be examined and strategies can be formed to resolve and improve the issues concerned. In the text analysis, themes from these texts will be highlighted by the text miner software. These themes are found in one or many documents (or comments) from all the students. Text cluster and topics are used to exhibit themes from these unstructured texts. With this knowledge, the following research questions are asked and will be answered at the end of this paper.

- What are the key concerns of the students when they arrive at a university?
- What are the key concerns of the students when they live either in/near the university?
- What are the key concerns of the students in their learning activities?

V. RESEARCH METHODOLOGY

This research uses secondary data set from a survey carried out by a private university which collects feedback from all students on several aspects of their university life. The data on students' feedback are unstructured text. All students are asked to enter their comments on voluntarily basis. The population size is the total population of the university. Due to data

privacy and confidentiality, the data provided by the university has no students' private detail such as name and identification number, and the name of the university. To carry out data analysis, this research uses SAS Text Miner. For the text miner to analyze any corpus of documents or texts, a minimum of 15 pieces of unstructured text is required. Student feedbacks are imported into Text Import. Text parser is used to break every sentence into tokens or terms so that unwanted or noises from these sentences will not be processed further. The output of the parsing activity are used as inputs for Text Filter. The text filtering process will filter the tokens or terms based on the dictionary, multi-terms, stem words, stop-list and start-list definitions used. In SAS Text Miner, the Text Cluster node will discover themes and assign each document to one of these themes. Similarly, the Text Topic node will discover themes but assign each document to zero or more of those themes. Text Cluster node is suited for documents that generally focus on a particular topic because when multiple concepts are present in a document, the chosen theme could be 'biased' (for lack of a better word). For example, in a customer survey, respondents will sometimes respond with the following feedback: "Your product could use some improvement. Here are three suggestions: 1) the colors don't work together or match other products. 2) It's too expensive for the features provided. 3) It's much larger than your competitors." In this case, the Text Cluster node determined three themes from the corpus: Improve color, improve pricing, and improve size. And the Text cluster node will magically mathematically assign the comment (document) to one of the above themes. Picking one ignores the other two items written in the document. The Text Topic node would likely assign the document to all three themes. This allows analysis in the paper to examine key issues in the form of key terms from the students' feedback. Visual concept maps are used to link key concept (from the key term) to related sub-concepts. Lastly, topics and clusters are highlighted by the text miner software. The research methodology in this research is summarized in the Fig. 1.

VI. ANALYSIS AND DISCUSSION

In this section, key terms that touch on important issues or concepts are ranked using weight (or level of importance) by the text miner will be analyzed and explained using the feedback students entered in the survey. From the feedback provided by the students, many issues can be highlighted to the university operator and this allows better strategy to be formed and hence improve quality of university students' experience. In this analysis, topics or themes and cluster of themes surfaced by the software will be discussed. In addition, each topic is examined closely in this section. Multiple themes surface from corpus of feedback (because each feedback is stored in an individual database cell) are grouped in each cluster so that comprehensive plan can be suggested to solve relevant issues to improve the quality of student experience in the university.

The outcomes of the text analysis are analyzed and explained in each sub-section. This paper focus on experience of university students while they Arrive at the university; their Learning experience as they started their classes, and their experience with respect to their Living condition. In this

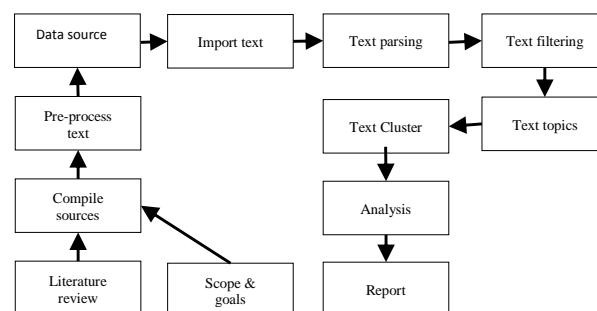


Fig. 1. Research methodology.

Terms				
TERM	FREQ	# DOCS	KEEP	WEIGHT
orientation	8	8	<input checked="" type="checkbox"/>	0.133
student	8	5	<input checked="" type="checkbox"/>	0.422

Fig. 2. Key terms for "Arrival" feedback.

the orientation was quite long and became boring
More counters should be set up during the first day of orientation for the registration. Do provide more students helpers or staff to guide new students into the queue as new students are unsure where they should line up as the notices set up at the front of the registration table weren't visible to those students at the back of the queue.
The orientation should include more interpersonal and communication-based activities
Please have a campus tour on the first day of orientation. It is very hard for first timers to find classes and location around.
Orientation is boring
It's a very welcoming orientation by all the seniors from the course i am taking.
the orientation was very informative.Helped me to adjust easily to the new environment
Arrival was great but would suggest for the receiver to be patient as baggage reclaim taked time. Orientation was good but being an international student, it was confusing understanding the way of speaking. Furthermore, getting to know the academic staff was average, not that detailed.

Fig. 3. Samples feedback for "Orientation" key term.

investigation, due to insufficient feedback collected for "Arrival", this category of feedback has limited analysis and discussion. "Learning" and "Living" feedback will be discussed and explained in detail.

A. "Arrival" Feedback

The "Arrival" feedback captures the students' experience when they arrive at a university. This is used to capture the services provided to these students by the university in term of transport, reception, lodging, courses registration and so on. Fig. 2 shows the top two key terms that are important to students after they arrived at the university. These terms are "Orientation" and "Student". These two key terms were mentioned frequently in their feedback when they were asked about their experience as they arrived at the university. "Orientation" was mentioned eight times in eight documents and "student" was mentioned eight times in five documents with weight 0.133 and 0.422 respectively.

Some sample feedback entered by the students are shown in Fig. 3. As one can see, some of the feedback from students include "orientation was quite long and became boring", "orientation is boring" and "the orientation was very informative. Helped me to adjust easily to the new environment". These feedbacks can be extracted and viewed to understand their full remarks.

Terms				
TERM	FREQ	# DOCS	KEEP	WEIGHT ▼
campus	6	4	✓	0.722
full	5	4	✓	0.702
different	5	4	✓	0.702
internet	5	4	✓	0.702
resource	9	4	✓	0.693
especially	4	4	✓	0.69

Fig. 4. Key terms for “Learning” feedback.

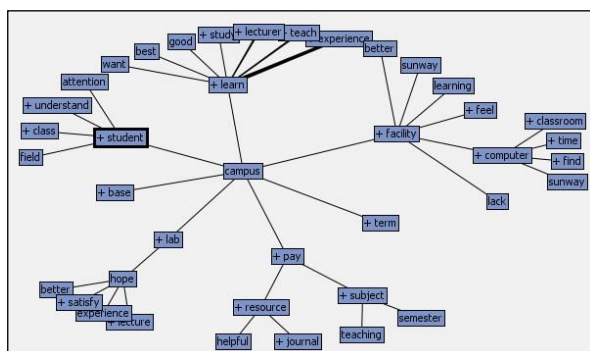


Fig. 5. Concept map for “Campus”.

<p>The learning experience here in Sunway is fairly satisfactory for me. However, there are some aspects that need to be reconsidered. Group assignments are often assessed very unfairly. This is due to the fact that often, only one or two individuals in a group would be slaving over the assignment, while the remaining members are as though hitch-hiking for free course marks. Often, this issue is overlooked; leading to unfair assessments. Although group assignments are important for training teamwork and good character as a team member, it also presents a fairly high degree of unfairness to many students. Reporting these issues to lecturers are also unfavorable for many fear that they will have to suffer backlash from their lecturers or even their peers if they do so. Secondly, there is a lack of IT facilities around campus due to the ever increasing amount of students. Based on my programme, there is a need for more science lab facilities to provide better learning opportunities for students. We are grateful however for the new Sun-U Building that is expected to elevate these issues.</p>
<p>The teaching staffs were generally knowledgeable and were very helpful in terms of supervision for post graduate studies by never failing to offer their guidance and assistance when needed. However, one key shortcoming was the really poor array of journals available through EBSCOHOST. In fact, most of the journals (if not all) that I needed for my studies were NOT available to me because the institution did not subscribe to it. This made the learning experience a really negative one because I was pursuing a research based programme. How am I going to complete my studies if I have almost no access to information that I need? I have to fork out additional cost on my own expense. This leads me to question as to why am I paying exorbitant resource fees prices because I'm not really directly benefiting from any of the resources provided. Also, the WIFI on campus is REALLY lousy and embarrassing to even mention. Might want to work on that: It's most of the time "down", or on the rare occasions that it is "available", it's extremely slow. I have tried this at different locations on campus, and if you're wondering, no, it doesn't matter which part of the campus you are, the problem still persists.</p>
<p>Library is usually crowded. Therefore we would have to opt for the foyer to study, but the foyer is usually crowded and noisy as well. There isn't enough quiet space in campus to study. Internet speed should be enhanced.</p>
<p>In terms of facilities through the campus: 1) Please install more computers in the library as the current number is not enough for some students. 2) Open up the Apple Mac lab for students to use since we are paying for it as well 3) In classroom (EB-G-4) for example, has not many plugs available. Students need more plugs in order to charge their technologies (tablets, computers etc.) in order to be productive and without any worry feeling of finding a plug to charge.</p>

Fig. 6. Samples feedback for “Campus” key term.

Due to small number of feedback on “Arrival”, some of the issues can be analyzed manually. From the samples in Fig. 3, it is clear that some of the feedback are very encouraging while others complained that “orientation” is too long and boring. From the analysis, it is useful to highlight several improvements to the orientation committee such as the duration of the orientation should be properly managed so that it is not too long because this will make students lost their attention.

B. “Learning” Feedback

The “Learning” feedback solicits remarks from students on their learning related activities. These include campus teaching and learning facilities, eLearning systems, hardware and software, and teaching staff in the university. Fig. 5 exhibits the top six key terms produced by the text miner software. The top four terms carry a weight of 0.722 out of a scale of 0.0-1.0 where they represent very important messages about student “Learning” experience in the university. “Campus”, “full”, “different”, and “internet” are frequently talked about. Out of four documents, these terms were mentioned five to six times. On the other hand, “resource” and “especially” were mentioned nine and four times respectively in four documents. They carry a weight of 0.693 and 0.69 respectively.

To further understand what are the related issues (or sub-terms) to these key terms, a concept map is useful to provide better picture for each of these key term. Text miner is able to present key concept and its relevant sub-concepts visually. The thickness of the line that link between two terms (or concepts) indicate they are closely related. Fig. 5 shows a concept map using “Campus” term. It is found that “learn” and “experience” are linked by a bold and thick line. This allows one to drill down the feedback provided by the students to examine the related issues on these two concepts. It is also found that not all feedbacks are negative, some are positive. Positive feedback from students such as “facility” – “better”, “learn” – “good” and “learn” – “experience” are encouraging indicators to the university operator. However, areas that need improvements are also highlighted. These include “lab” – “hope” – “better” and “facility” – “lack”. In text miner, these concepts can be further deepened by zooming into the next related level of feedback provided by the students in order to study related issues. With these related terms (or issues), full comments provided by the students can be displayed in the software. University operator can make an attempt to satisfy the expectation of the students hence improvements can take place.

In Fig. 6, some samples feedback on the term “Campus” are listed. These feedbacks allow one to examine the full remarks provided by the students on “Campus”. For example, a student states that “... learning experience ... fairly satisfactory. ... lack of IT facilities ...”. This comment is an example that reflects on the concepts (or terms) highlighted in the “learn” – “experience” and “facility” – “lack” links in the concept map. For a particular category of feedback that have too few comments (where terms that appear less than certain threshold number of comments), this category of feedback will not be reflected in the concept map. Hence the terms generated in this category of feedback does not have very high weight.

“Internet” is another important term mentioned by students. Using concept map allows other related concepts and sub-concepts on “Internet” to be illustrated. The “Internet” concept map is illustrated in Fig. 7. Based on the map, the “Internet” - “experience” - “overall” – “problem” – “always”, “internet” – “learn” – “teach” links are thick bold line. These links represent concepts in the links are important and closely related. The comments entered by the students can be found by searching for “Internet” + “experience” + “overall” + “problem” + “always” phrase. An example is shown in Fig. 8.

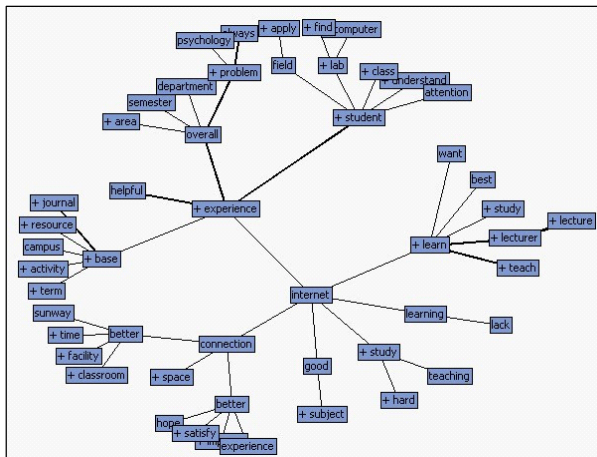


Fig. 7. Concept map for "Internet".

My overall learning experience had been satisfying but I do wish for more resources for me to use like a recreation room for students in psychology for us to do group discussion as we are not allowed to use the observation rooms for that and we often have trouble to find a proper spot for group discussion. Also I hope that the older classrooms would be maintained better because we often had problem with the projector, the sound system and so forth. And of course more resources like journals and psychology book would always be more helpful for us students. My opinion is based from what I experience from my department. I hope that this opinion would be look up upon for the benefits of students that would join Sunway University later on.

Fig. 8. Samples feedback for "Internet" key term.

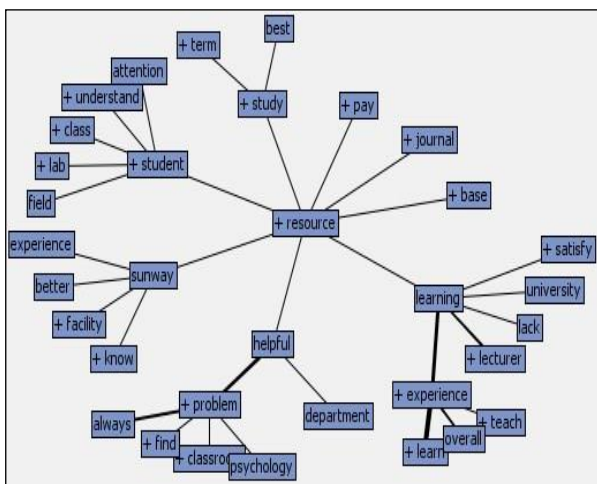


Fig. 9. Concept map for "Resource".

Learning requires better facilities. Students in Sunway students are paying resource fees however there is only limited resources to use. Without sufficient resources, it also affects students' performance in long run.

The teaching staffs were generally knowledgeable and were very helpful in terms of supervision for post graduate studies by never failing to offer their guidance and assistance when needed. However, one key shortcoming was the really poor array of journals available through EBSCOHOST. In fact, most of the journals (if not all) that I needed for my studies were NOT available to me because the institution did not subscribe to it. This made the learning experience a really negative one because I was pursuing a research-based programme. How am I going to complete my studies if I have almost no access to information that I need? I have to fork out additional cost on my own expense. This leads me to question as to why am I paying exorbitant resource fees because I'm not really directly benefiting from any of the resources provided. Also, the WIFI on campus is REALLY lousy and embarrassing to even mention. Might want to work on that: It's most of the time "down", or on the rare occasions that it is "available", it's extremely slow. I have tried this at different locations on campus, and if you're wondering, no, it doesn't matter which part of the campus you are, the problem still persists.

Fig. 10. Samples feedback for "Resource" key term.

Fig. 8 exhibits a sample of feedback. Based on the links that are highlighted in thick bold lines, a close examination on the link "Internet" - "experience" - "overall" - "problem" - "always" can be used to drilled down into the full feedback entered by the students. Fig. 8 exhibits the feedback provided by student in this survey.

"Resource" is another key term that was highlighted by students. The term "Resource" carries a high weight which means that students have mentioned "Resource" in many comments in the feedback. The concept map in Fig. 9 shows a snapshot of the linked concepts. One of the paths in Fig. 9 has a thick bold line. The "resource" - "learning" - "experience" - "learn" is a path that needs attention. The full comment of this link is shown in Fig. 10. Another link that has some thick bold link is "resource" - "helpful" - "problem" which connects to another related term such as "always" or "find" or "class of" or "psychology". These links can be examined in more detail by drilling down into the actual comments entered by students.

For example, "Resource" - "learning" - "experience" - "overall" has a bold thick link that indicates that these few concepts are very closely related and may bring important messages from the students. In Fig. 10, some samples of feedback were extracted based on "Resource" term. From "The teaching ... learning ... resources ...", one can see the concern coming from student in the university. This can bring new insights to what extend students dislike or like resources provided by the university. Hence, improvement can be planned and executed in the strategy.

Clustering of themes and topics from the feedback automatically group key related terms to highlight comments from the students. As pointed out in the earlier part of the discussion, grouping key terms allow one to visualize themes and topics in the feedback instead of some random terms that are difficult to relate. Fig. 11 highlights cluster of themes and Fig. 12 exhibits the key topics that students expressed in the survey. The key terms in the first cluster is "+lab +computer +find +classroom +facility +pay hope always campus especially full internet practical sunway +lecture". It covers more than more than 70% of all the feedback provided by the students. The rest of the clusters cover around 2-3% of the students' feedback. This means that students view "Learning" feedback from the perspectives of "+lab +computer +find +classroom +facility +pay hope always campus especially full internet practical sunway +lecture" as their key priority covering lab, computer, classroom, and internet resources.

Looking at the topics produced by the students, one can see that students have great concern on teaching of subjects by lecturers and ease of understanding, study space and internet connection in the campus, computers in the lab and internet services and so on.

+lab +computer +facility +find campus +classroom +pay hope sunway always especially full internet practical +base
+teacher attention different great interesting +understand semester few +class especially helpful life +know +problem teaching
+journal +study +base +learn +activity +resource always best campus different helpful people practical want +problem
field +teach +subject +class +understand +apply attention teaching +pay +learn +lecturer best helpful life +problem
+hard +activity +study +space campus internet practical +base connection semester +student +area +term lack overall
learning +resource university lack +know department +area overall always best great people +student +experience +feel
better connection +classroom experience sunway +time +satisfy +space especially internet +university few +computer hope +hard
work full +university +apply internet people practical +teacher connection semester teaching +term good +subject +lecturer
+lecture +lecturer +subject +feel +understand interesting university experience psychology hope +class sunway +teach +time +student
+improve +satisfy want good +facility psychology better +learn +find different especially interesting life +lecturer +know

Fig. 11. Cluster of themes.

Topic
+teach,+understand,+subject,+class,+learn
+experience,learning,+lecturer,want,overall
+study,+space,internet,connection,campus
+lab,+computer,hope,internet,+facility
+lecture,+lecturer,+understand,+subject,+feel
work,full,+apply,+lecturer,people
+activity,+base,+journal,experience,campus
+teacher,attention,great,+class,few
+facility,+improve,different,interesting,semester
field,teaching,+subject,+student,+class
+university,+learn,experience,sunway,department
better,+classroom,connection,+time,better
sunway,university,experience,+know,+subject
always,people,+problem,+learn,+know
+area,lack,+student,+subject,learning
+hard,+study,+classroom,few,+student
practical,especially,hope,+lab,+student
+feel,+term,+know,want,+subject
good,better,+subject,+lecturer,attention
+time,+know,+activity,sunway,+class
+resource,+student,+pay,sunway,campus
hope,better,+improve,+satisfy,connection
semester,overall,helpful,+subject,+area
psychology,+find,life,+improve,full
+study,sunway,best,practical,few

Fig. 12. Topics discussed by students on “Learning”.

From the analysis of “Learning” feedback, it has provided deep insights and detail views where data driven knowledge allows university operator to carefully making plan and strategy to solve and improve the overall satisfaction index among students. Each topic and cluster of themes has linked important terms semantically to drill into their correlation so that university operator is able to view a comprehensive picture of what students have expressed to the management to quest for more important or complement their good works from their past comments.

C. “Living” Feedback

As for “*Living*” feedback, we see a completely different perspective from the students. “*Living*” feedback captures quality of living related matters as a student in a university. This covers questions on safety, conveniences, transport, cost and quality.

In this section, the analysis highlights five (5) key terms that are of high concern by the students include “Car”, “Hostel”, “People”, “Allow” and “Improvement”. This section focus on “Car”, “Hostel”, “People” and “Improvement” (Fig. 13). This shows that students have something to say about “Car”, “Hostel”, “People”, “Allow” and “Improvement” which they want the university operator to listen to them. In order to find out the causes of their voices. Concept linked map is able to highlight all the other related terms (or issues) graphically. To read their original feedback, the text filter is able to zoom into these original text.

Terms				
TERM	FREQ	# DOCS	KEEP	WEIGHT ▼
car	6	4	<input checked="" type="checkbox"/>	0.697
hostel	6	4	<input checked="" type="checkbox"/>	0.697
people	5	4	<input checked="" type="checkbox"/>	0.696
allow	5	4	<input checked="" type="checkbox"/>	0.696
improvement	5	4	<input checked="" type="checkbox"/>	0.696

Fig. 13. Key terms for “Living” feedback.

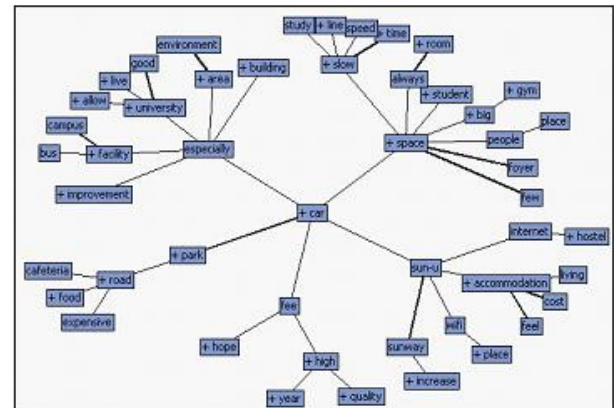


Fig. 14. Concept map for “Car”.

<p>Please improve the car parks outside side gate. Those shops are very annoying at owning the car parks illegally.</p> <p>Hostel Fee is too expensive! Many potholes in Sunway Area, spoil my beautiful one and only car that i have in my family. Provide car inspection for free especially absorber and suspension. Some of the guard in SunU Residence is very rude, like I owe them for few millions. Sunway Wi-Fi is very slow, do upgrade it for better connection. Limited parking in Sunway Area, and parking bay is very expensive. Limited study space. SunUResidence deserves better internet speed.</p> <p>If you ever choose to, please do something about parking availability. As much as the new car park has been established, parking rates of Rm5 is ridiculous. Even reaching college as early as 7am, parking outside by the shoplots to avoid paying Rm5 result in conflicts with shoplot owners claiming that the parking space is theirs. Worse with people who place tyres and wooden contraptions all over just to mark their dogly territory.</p>
--

Fig. 15. Samples feedback for “Car” key term.

In Fig. 14, the concept map for “Car” is illustrated. Fig. 14 focuses on “Car” as the key term to be analyzed. The links that connect “Car” – “space” – “few”, “Car” – “space” – “foyer”, and “Car” – “especially” – “area” – “environment” are some of the concepts links that have thicker bold lines. The thick bold lines mean these terms carry high weightage and important. They represent related concepts that are need some attention. The concept map visually illustrates related concepts expressed by the students and the visual presentation allows ease of illustration and explanation.

Fig. 15 shows examples of feedback for “Car”. By zooming into the source of the feedback, one is able to read what students want to tell the university operator. For example, “Car” – “space” – “few” highlights car space available in the university is scarce. For example, the feedback “Hostel ... car ... few ... space ...” is one of those feedbacks that is used to construct this concept link. In summary, the visual presentation of the concept map allows quick and fast overview of the overall related concepts relate to “Car” key term.

Another key issue that expressed by the student in “Hostel”. In Fig. 16, the concept map for “Hostel” is illustrated. In Fig. 16, “Hostel” – “student” – “university” – “road”, “Hostel” –

“student” – “food” – “cafeteria” and “Hostel” – “student” – “food” – “living” are some of the links that connect few concepts using thicker bold line. These links show some closely related concepts that need attention from the university operator.

Some of the samples feedback on “Hostel” are presented in Fig. 17. In the concept map, “Hostel” – “internet” – “line” and “Hostel” – “speed” – “slow” links can be related to feedback such as “hostel ... internet ... slow...”. The original feedback provides full comment from students.

In Fig. 18, the concept map for “People” is illustrated. In this concept map, “People” – “food” – “expensive” seems the only link that has stronger relationship between concepts.

Fig. 19 shows some sample feedback on the “People” concept extracted from content in the survey. Detail of feedback can be further analyzed from the complete content illustrated in Fig. 19.

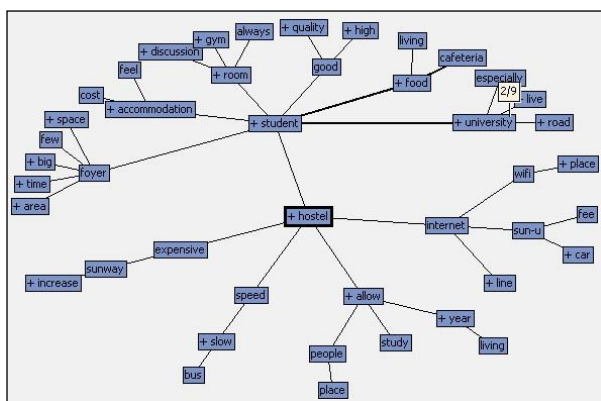


Fig. 16. Concept map for “Hostel”.

<p>hostel internet have too many limitation and the speed is slow, and the rental for hostel is too expensive</p> <p>Hostel Fee is too expensive! Many potholes in Sunway Area, spoil my beautiful one and only car that i have in my family. Provide car inspection for free especially absorber and suspension. Some of the guard in Sun-U Residence is very rude, like I owe them for few millions. Sunway Wi-Fi is very slow, do upgrade it for better connection. Limited parking in Sunway Area, and parking bay is very expensive. Limited study space. SunUResidence deserves better internet speed.</p> <p>Not being allowed to cook in the hostel. No oven or microwave is provided. What sense does it make for a student hostel to not allow students to cook?</p>
--

Fig. 17. Samples feedback for “Hostel” key term.

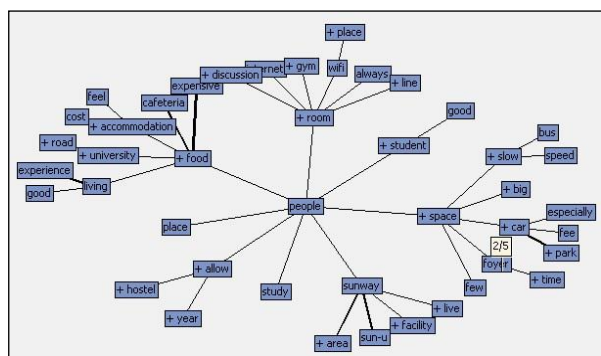


Fig. 18. Concept map for “People”.

In Fig. 20, the concept map for “Improvement” is illustrated. The “Improvement” concept is found to have stronger link to “park” – “car” – “space” where Fig. 21 illustrates sample feedback on the “Improvement” concept.

Fig. 22 shows the themes generated by the text miner presented by the text cluster. In the text cluster, it is found that two clusters are more important than others. They are “+big foyer wifi +line +gym +space +room always +student few

<p>Inadequate wet space for worship of my own belief and gods. The school seems to prioritize muslims with prayer rooms but don't seem to understand that perhaps people of other faiths would appreciate a private room of their own. Food here is terrible and incredibly pricey, no to mention the heat and badly designed cafeteria that remains filled with odors and oily floors everyday. It beind a cafeteria is no excuse as my involvement with the Sunway International School has clearly shown me the lengths which Sunway goes to prioritize the cleanliness of a space ONLY IF there were international or wealthy students involved (YOUR LIES ARE MEANINGLESS).</p> <p>Truth is, Sunway is an expensive place to live. My pocket money does not allow me much choice when it comes to food. However, this is not the university's concern - rather mine. People who study here are rich and it is hard to keep up. As for scholarships, I find it quite sad that people who perform well during the academic year do not have the opportunity to upgrade their scholarship. I find it unfair that some students, who already possess a higher tuition fee waiver, get lower grades than I do, yet have a higher waiver than me the following year. Also, I'm just hoping that the university will be more comfortable when all this construction is over.</p> <p>Firstly, the environment around the "smoking area - the place where the signs of No Smoking In Campus" is horrible. The stench is horrible, and people may even drop their cigarettes there. Secondly, the roads to the university/parking lots are horrendous. They are bumpy and not straightforward. I.e. From LDP, I need to go around Taylor's to get to Sunway's (shopping mall) parking lot. Thirdly, the food around here are expensive and unhealthy. Even in the cafeteria, the portion size could be inconsistent while charging students with at least rm5 with just rice, fish (the flour covered type that taste like flours) and whatever greeneries. I am pretty sure MSG and salt cost some money, so why not reduce it?</p>

Fig. 19. Samples feedback for “People” key term.

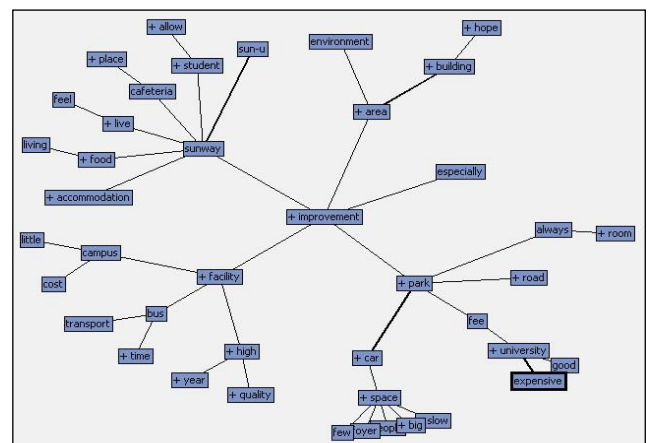


Fig. 20. Concept map for “Improvement”.

<p>The surroundings, appearance and facilities will definitely see a large improvement with the completion of the new Sun-U Building in the near future. However, current issues at the existing campus that need to be tackled includes the smokers area near the side entrance at North Building as well as the road conditions and congestion. Smokers should not be smoking at the said area as it is supposedly designated as a non-smoking area. Plus, the many smokers that crowd the area may smear the good name of Sunway University. I would like to suggest a closed area specifically for smokers outside the public eye. Not only is it healthier for non-smokers walking that area, it protects the University's image as well. Parking and road conditions at and surrounding the University is really in need of improvement. Potholes and uneven road surface has caused damage to my and several other coursemates cars. Also, the relatively high parking fee at the New Building parking lot should be reduced by RM1/2 to ease students expenses, especially those in financial difficulties.</p> <p>Although Sunway facilities are great, there can be improvement on some areas like having a parking area at the side lines where parents could wait. Some classrooms also have a damp odor which is unpleasant especially in NE 2-11.</p> <p>Parking facilities needs improvement</p>

Fig. 21. Samples feedback for “Improvement” key term.

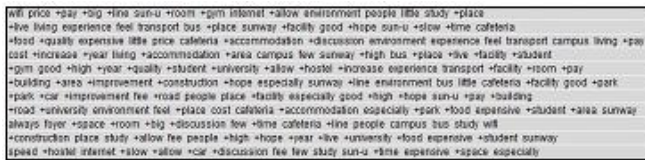


Fig. 22. Cluster of themes.



Fig. 23. Topics discussed by students on "Living".

people study +slow +time cafeteria" and "good +university +quality experience +high +year +road especially +accommodation +allow +discussion +hostel +increase feel transport". This has clearly shown that students are concern with the wifi in the foyer, room and cafeteria areas where the connection speed is slow. Another key message is on the experience of student on accommodation and hostel in a good university. Students also request to have more discussion area in the university.

Fig. 23 shows a list of topics produced by the text topics function of the text miner software. From the key topics, several themes can be derived from them. Among them, messages such as "food in cafeteria is expensive", "increase areas in Sunway", "foyer to have space for students", and "car park good but fee and space is of concern". With these themes in all the topics surfaced by the software, more detail can be further obtained from the feedback entered by the students.

VII. CONCLUSION AND FUTURE RESEARCH

The outcomes from the text mining activities are capable of highlighting key terms where they are concepts or issues that are most talked about among students. In the concept map, sub-concepts that are linked from the key concept can easily be traced and understood easily. With these links, feedback that need to be further analyzed can be easily found from large amount of texts. For text clusters and text topics, one can trace down each theme all the way to the source of the information, that is the feedback from the students. In short, text analytics allow large amount of unstructured data to be well processed and understood easily and fast. The strength of visual concept maps make concepts easily explained and presented to non-technical audiences.

REFERENCES

- [1] M. Shrimoyee, "Theoretical framework for analyzing International students' concept of expectation and consumer satisfaction in an International University," E-Leader Bangkok, 2014.
- [2] S. P. Leeman-Munk, E. N. Wiebe, and J. C. Lester, "Assessing elementary students' science competency with text analytics," in *Proceedings of the Fourth International Conference on Learning Analytics And Knowledge*, ACM, Mar 2014, pp. 143–147.
- [3] R. Ferguson and S. B. Shum, "Learning analytics to identify exploratory dialogue within synchronous text chat," in *Proceedings of the 1st International Conference on Learning Analytics and Knowledge*, ACM, Feb 2011, pp. 99–103.
- [4] P. Blikstein, "Using learning analytics to assess students' behavior in open-ended programming tasks," in *Proceedings of the 1st International Conference on Learning Analytics and Knowledge*, ACM, Feb 2011, pp. 110–116.
- [5] W. Fan, L. Wallace, S. Rich, and Z. Zhang, "Tapping the power of text mining," *Communications of the ACM*, vol. 49, no. 9, pp. 76–82, 2006.
- [6] M. Grobelnik, D. Mladenic, and M. Jermol, "Exploiting text mining in publishing and education," in *Proceedings of the ICML-2002 Workshop on Data Mining Lessons Learned*, 2002, pp. 34–39.
- [7] M. Gamon, A. Aue, S. Corston-Oliver, and E. Ringger, "Pulse: Mining customer opinions from free text," in *Proceedings of the International Symposium on Intelligent Data Analysis*, Springer Berlin Heidelberg, Sep 2005, pp. 121–132.
- [8] N. A. Othman, *Prior Educational Experiences and Cultural Factors in the Learners' Attitudes and Behaviours: A Case Study of Distance Learning English Course at UiTM, Malaysia*, Vol. 1, PhD Thesis, 2009.
- [9] N. Alam Siddiquee, "Public management reform in Malaysia: Recent initiatives and experiences," *International Journal of Public Sector Management*, vol. 19, no. 4, pp. 339–358, 2006.
- [10] A. Che Rozaniza, R. Asbah, and P. Rajalingam, "Promoting positive mental health among students in Malaysia," *Psychology and Behavioral Sciences*, vol. 2, no. 2, 2013, pp. 73–82. doi: 10.11648/j.pbs.20130202.18.