

Understanding the Influence of Mosston's Spectrum of Teaching Styles Using Sentiment Analysis

Las Johansen B. Caluza, PhD

Abstract

Teaching style is inevitably essential in the profession of instruction. Understanding the influence of teaching style used by the Professors is equally important in building a foundation of how learners appreciate in the delivery of education. In this study, the Mosston's Spectrum of Teaching Styles used by the Professors of MPE Students was explored through the use of exploratory design of mixed methods approach in research. The Graduate Students were asked using open-ended questions about their views on the teaching styles employed by their Professors. Text mining technique was used in processing these views using sentiment analysis. It revealed that positive feelings were discovered and formed significant themes describing how Professors in the MPE program in the graduate school employed the different teaching styles and the influence itself to the professional growth of the learners.

Keywords: Teaching Style, Student Learning Outcome, Mosston's Spectrum, Physical Education, Mixed Methods, Exploratory Design, Text Mining, Social Science

1.0 Introduction

An effective teacher is someone who influences its students and peers as an educator and a mentor. He uses different teaching styles and strategies, making his discussion more interactive learning and entertainment are also known as *Edutainment*. To be an effective teacher, he must possess certain characteristics that appear again and again such as analytic and or synthetic approach, dynamism and enthusiasm, instructor-group interaction, and instructor-individual student interaction (Characteristics of Effective Teachers, nd). In an article found on the internet site of Gordon College described Teachers impact on our learning, development, and even on what we become. Teaching styles employed by the teacher were easily recognized by the learners once the students quickly adopt, learned, and interactively participate in the classroom discussions. Teaching styles of a teacher significantly affect the transfer of knowledge from the teacher to the learners. In a study conducted, it reveals that matching of learning styles of the students and the teaching styles used by the teachers significantly improved the students' reflection level in a ubiquitous learning (Hsieh, Jang, Hwang, & Chen, 2011). U-learning is a learning paradigm which takes a position in a ubiquitous computing environment that enables determining the proper thing at the correct place and time in the right direction (Yahya, Ahmad, & Jalil, 2010). This indicator alone reveals the importance of matching the teaching styles and the learning styles of the students in improving their knowledge. Among the most prevalent teaching styles used by the teachers in the graduate program were guided discovery, practice, and self-check approaches (Las Johansen, B.C., Diaz, M.V.A, & Gabon, R., 2015). The graduate program of a university consists of professionals, practitioners, experts, and teachers in the field and the industry. It is empirical to understand the influence of the different teaching styles used by their professors in their actual work or the area to discover if they apply these learnings in the real world.

2.0 Research Problem

This research explored the sentiments of the participants concerning the different experiences they encountered on the kind of teaching styles used by their Professors in the Graduate Program in the Master in Physical Education (MPE). Also, this research investigated the influence of these teaching styles in their daily activities.

Specifically, this study seeks answers to the following questions:

1. What are the most prominent keywords in the word cloud derived from the corpus of sentiments?
2. What are the words associated with the keywords from the word cloud?
3. What are the experiences and its implications in using the various teaching styles?
4. What are the learning outcomes as experienced by the participants?

3.0 Theoretical Framework

The use of unstructured data in a research tries to find out the hidden patterns from the massive dataset. This study employed the *Rough Set Theory* of Pawlak, Z. (1998) and was further explained by Matsumoto & Watada (2015). Which says that the *theory is useful for domains where the information collected is vague and or incomplete about the field objects*. It offers a powerful tool for a data analysis and data mining of imprecise and ambiguous information. Rough set theory has many advantages, such as providing efficient algorithms for discovering hidden patterns in data, seeking minimal sets of information (data reduction), assessing the significance of data, and bringing forth the minimum sets of decision rules from data. It is easy to understand and to offer a straightforward rendering of the results (Matsumoto & Watada, 2015). The research adopted the framework introduced by Williams (2014) to set the process in this theory. The first is to text mine the data from the unstructured data sets, then load it as a corpus. A corpus is simply a collection of information, documents, and other related data used for analysis. Followed by data extraction, cleaning, and stemming ready for data processing. In support of the data mining, processes, and the generation of knowledge, this research will employ the theory of cause and effects which was introduced first by Aristotle's Theory of Causality as explained by (Facon, 2008). It says each Aristotelian science consists in the causal investigation of a particular section of reality. *If successful, such an exploration results in causal knowledge; that is, knowledge of the relevant or appropriate causes*. Moreover, the causality theory of Aristotle (Aristotle on Causality - Create Advantage, ND) was explained further by understanding the human experience of physical nature. There may be multiple causes, but there is only one or the fundamental source of origin called the teleology. Teleology is then the one primary source of change, the motivational progression (that is, the basis of objectives and values) hidden within the groups of the efficient and formative cause. In this sense, teleology is subordinated to the other causes, rather than accepting them as in Aristotle's thinking. In the above examples, what motivates people are reduced to cause (sales incentive), and effect (change in sales) link, or just stated as a profit goal without taking account of how such a goal ascends in the self-organizing complex receptive processes we are pointing to. In using the term Transformative Teleology, we are trying to draw attention to the self-organizing composite reactive processes of emerging values, goals, strategies, and so on. The statements above reinstates teleology to its overall position in a theory of causality.

4.0 Research Design and Methods

4.1 Research Design

This research employs mixed methods using Exploratory Design (ED), which it deals with both qualitative and quantitative information in generating new knowledge. ED's results of the first method (qualitative) can help develop or inform the second method (quantitative). The basis of this design is on the premise of exploring information needed due to any of the following reasons; like no instrument available, unknown variable, no guiding framework, and unstructured data (Creswell, 2013). In support, Mixed method research is a study design that deals with philosophical assumptions and as well as the methods of inquiry or collecting data (Creswell & Clark, 2007).

4.2 Research Methods

In this research, the participants were 15 Graduate Students of a University enrolled in the MPE program. Students' were asked using open-ended questions about their sentiments on the type of teaching styles that their Professors were using. Later, the data were collected through their narratives on the subject matter and were encoded in the Notepad software and was saved using an extension name as TXT (Text file) and later was formatted with a file with an extension name of ARFF (Attribute-Relation File Format). The use of these file formats was in the processing and analyzing in the text mining processes.

This process was based on the two phases as suggested by the research design used in this study, which the first part is on the qualitative part. The second part of the method is in the generation of the quality data in the graphical and quantitative result. In this process, text mining technique specifically the use of sentiment analysis was employed to explore and understand the experiences of the participants through profound data exploration of the responses in philosophical assumptions.

In sentiment analysis, the unstructured dataset was analyzed using a systematic approach such as data extraction using R-programming to generate the word cloud, word frequency, word graph, word association. The purpose is to convert and create machine language. The use of this converted data is to understand the sentiments, and its meaning is to understand human expression through language (Ray, 2012). The purpose generating terms as mentioned above was to establish keywords to be used in data mining the qualitative text corpus to its associated sentences. Once a keyword is created, the researcher use only the tops three (3) keyword in the investigation using its philosophical assumptions as the keyword were the most frequently used keyword in the text corpus. These terms were now the basis in search its associated sentences using the word tree. Once generated, sentences will have its formulated meanings. Finally from the formulated meanings, Theme Clusters will be formed.

4.3 Research Reflexivity

The personal reflection of this research is to focus on the perceived experiences of the participants on the type of teaching styles their professors were using in their classes. It is important to understand these experiences to explore further the actual transfer of knowledge through its applications in practical education and professional development of the participants. The derived inputs or knowledge gained from this study will help future researchers enhance our educational approaches, processes, and systems.

4.4 Ethical Considerations

The position of this research is mere to explore and understand the deeper meaning of words used and expressed by the participants from the interview conducted by the researcher. Furthermore, to avoid misconceptions or undesirable events such as moral and personal considerations, the names of the participants will remain hidden.

Results

Table 1: Distribution of Sentiment Classifications

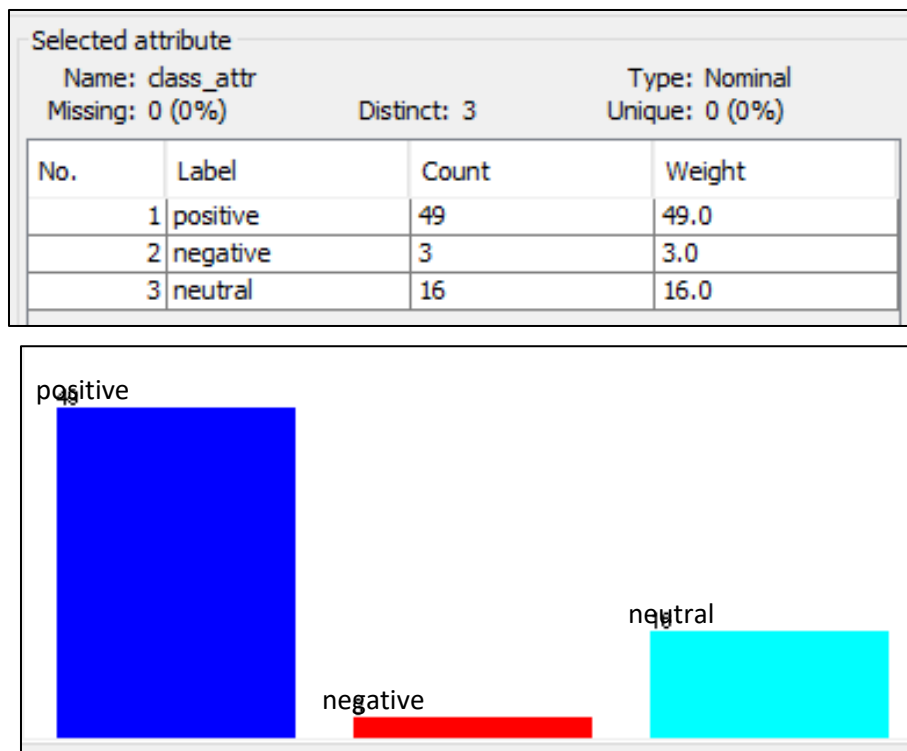


Figure 1: Graphical Presentation of Sentiments

Based on the classifications of the Sentiments, as shown above, it is very evident that most of the feedbacks were positive with Weight of 49.0, neutral with 16.0 weight, and negative with 3.0 weights. With findings, we can say that most of the Graduate Students were satisfied with the type of teaching styles used by their Professors.

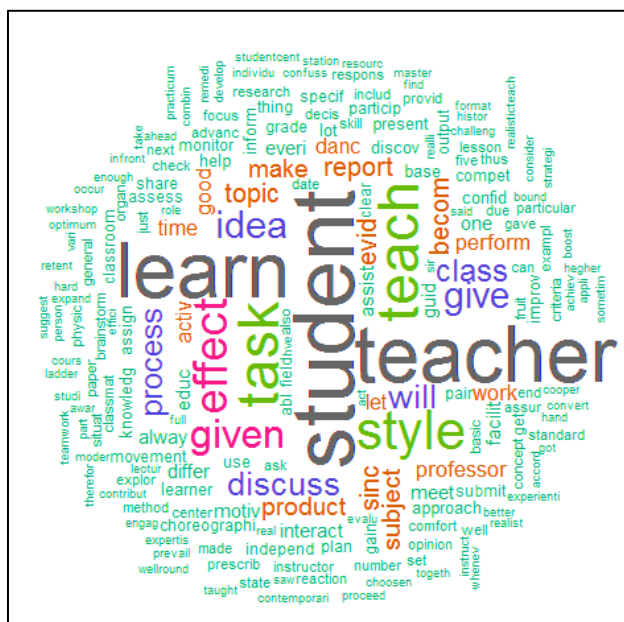


Figure 2: Word Cloud of Sentiments in the MPE Program

As presented in figure 2, it was very evident that there were three (3) most prominent words found in the corpus, these were *student*, *teacher*, and *learn*. The philosophical assumption of these words was the relationships between the two entities (*student*, *teacher*) confirms significant attachment in the educational system. A fascinating study explained the student-teacher relationships as fundamental to success in school and should explicitly target in school-based prevention and intervention efforts (Hamre & Pianta, 2006). As such, the relationships have a complex intersection of student and teacher beliefs, attitudes, behaviors, and interactions with one another, in this process both entities *learn* from each other. To find out how these words frequently used in the corpus, table 2 present the term-document matrix of word frequency in which the term *student* with 40 times, a *teacher* with 37 times, and *learn* with 36 times mentioned in the corpus. While the following keywords show significant connections between *student* and *teacher* relationships, such as *task*, *teach style*, *effect*, *given*, *ideas*, and *give*.

Additionally, recent findings also suggest that student-teacher relationships help prevent a student in becoming alienated or disengaged by understanding the practical applications of teaching and learning by enhancing interpersonal and intellectual capability of the student through the assistance of the teacher (Crosnoe, Johnson, & Elder, 2004). The psychological valence of the words (*student*, *teacher*) has significant relationships in attaining quality academic motivation and engagement of the student's extra-curricular activities. It said that a well established theoretical relationship between *student* and *teacher* shows important implications for student's future academic and behavioral adjustment (Hughes, & Kwok, 2007).

Table 2: Term-document Matrix

Word	Frequency
student	40
teacher	37
learn	36
task	25
teach	25
style	24
effect	20
given	16
idea	15
give	14

This research further expands its capability in digging for the enlightenment of the meaning of the words (*student*, *teacher*, and *learn*) by understanding further the most attractive terms in the sentiment corpus. To find out the causality of a keyword in the text corpus and determine the connections of the keyword generated from the term-document matrix this research employed the word association. Word association arises in the human mind when reading or saying a word, or just thinking about the word to determine its philosophical assumptions; it's causes and effects of the statement (Word Association Lookup [def. 1], 2016). It is also a method sometimes used in psychoanalysis, in which the treated individual would say the first word they think of when a particular word is said, which may help to determine how parts of the mind work (Word Association [def. 2], 2016). As shown in figure 3, the result of finding associations of the word *student* with a correlation limit of 0.3 presents several word associations describing and explaining the psychological valence of the term.

```

> findAssoc(word, term = "student", corlimac = 0.3)
$student
  achiev comprehension cooper deliv evalu format
    0.75      0.75      0.75  0.75  0.75    0.75
guidanc higher imetanc level optiam order
    0.75      0.75      0.75  0.75  0.75    0.75
organ retenc set skill standard strenght
    0.75      0.75      0.75  0.75  0.75    0.75
taught teamwork think taught weak workshop
    0.75      0.75      0.75  0.75  0.75    0.75
discover explor guid perform ask exampl
    0.61      0.60      0.60  0.53  0.52    0.52
provid assess teacher facilit improv assess
    0.52      0.48      0.48  0.47  0.47    0.44
well knowledg topic aware becom depend
    0.44      0.42      0.37  0.31  0.31    0.31
exchange listen
    0.31      0.31

```

Figure 3: Word Associations of the Term “student.”**Table 3: Causes and Effects of the Learning-Outcomes of the Term “student.”**

Cause	Effects				
Workshop	comprehension retention organization	think perform facilitate	depend achieve explore	listen knowledge set	provide
Teamwork	discover exchange	order aware	evaluate assess	deliver skill	
Cooperation					

Seeing into the extracted words from the generated word associations of the term “student” in Table 3 shows the keywords that philosophically made causes using the Mosston’s Spectrum of Teaching Styles, and its associated terms as an effect using Learning-Outcomes as its teleology term as explained in the framework. Apparently, when a participant attends a workshop and become a member and is expected to get together during group activities. As a result, comprehension from the exercise given will retain, they will be able to discover, exchange of ideas, they conceive, perform, facilitate, explore, even evaluate their output, they must listen and provide or set goals.

Workshops, teamwork, and cooperation are essential in attaining pertinent objectives. In a study (Forsetlund, Bjorndal, Rashidian, Jamtvedt, O’Brien, Wolf & Oxman, 2009), discovered that interactive workshops significantly improve the performance of the participants. In fact, peers and teachers have expressed the importance of workshops such as it boost teamwork, participation and interaction, gain skills and confidence, independence and self-directed learning in nature (Lai, 2010). These only indicate that value of the workshop in the learning process.

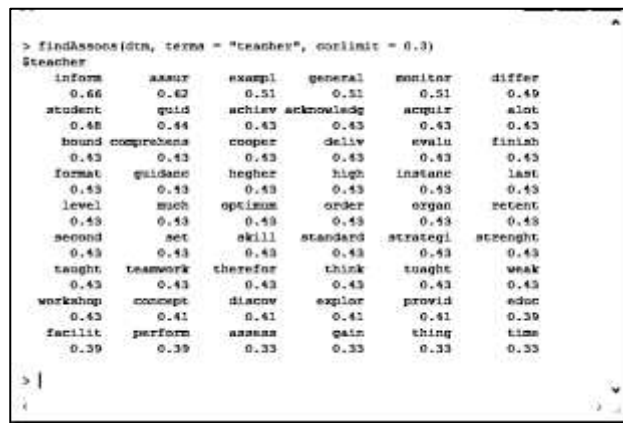


Figure 4: Word Associations of the Term “teacher.”

Another term that was frequently told by the participants was “*teacher*.” Figure 4 shows the keywords associated with the *teacher*. To find out what causes and its effects, it was analyzed and grouped philosophically. As a result, Table 4 shows the terms that induce an impression when a teacher conduct classes with his students or the participants.

Table 4: Cause and Effects of the Learning-Outcomes of the Term “*teacher*.”

Cause	Effects				
Workshop	organization	achieve	acquire	think	gain
	guide/guidance	deliver	skill	explore	inform
	cooperation	acknowledge	order	concept	comprehension
Teamwork	retention	evaluate	strategies	perform	provide
	example	monitor	discover	assess	taught
Facilitating					

When a *teacher's* conduct classes in the graduate school what causes the participant to find out is when the teacher hold a workshop type of divisions as its strategy and the *teacher* facilitate the full duration of the course of study. As its effects, the participants noted that the *teacher* guide, cooperate, provide examples. The teacher also delivers the lessons, evaluate, and monitor the class to pull ahead, acquire, and accomplish the goals of the class through retention and developing its skills and improve comprehension about the subject matter taught in the course of study.

As its learning outcomes, the participants gain insights into the strategies used by their *teacher* and has the possibility that the learnings they gain from the *teacher* will also transfer to its peers and students. Research findings revealed that conducting strategy workshops provide some insights into the scale and scope of these actions and the extent to which and in what ways they help contribute to the efficient development and implementation of strategies in organizations (Hodgkinson, Johnson, Whittington, & Schwarz, 2005). As students' confidence increases and as both they and their instructors are eager to foster joint decision-making in lessons, there is more chance of them becoming self-led and moved enough to have input into the direction and theme of classroom activities. In such circumstances, teachers' roles as facilitators will be much more prominent (O'Dwyer, 2006).

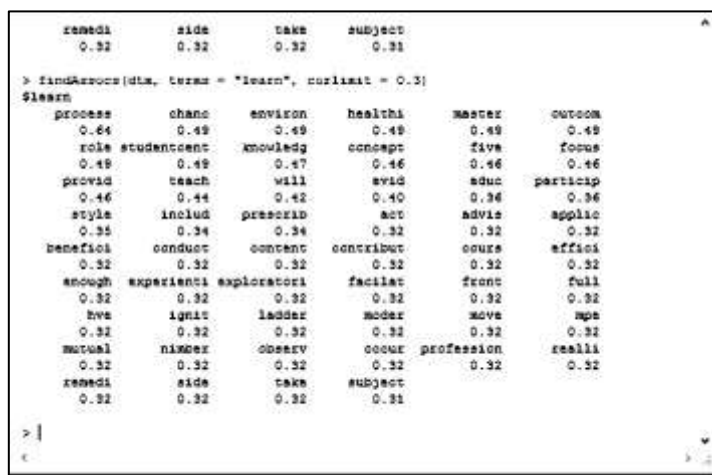


Figure 5: Word Associations of the Term “learn.”

The third term in the text corpus of participants' responses was “*learn*”. The same process was made in the previous terms when determining its associated terms in the text corpus. This study will try to obtain the causality of the keyword *learns* using its philosophical assumptions on the keywords generated through text mining. The Table 5 shows what causes the keyword *learn* based on the participants' views and reveals its effects during the learning process.

Table 5: Cause and Effects of the Learning-Outcomes of the Term “*learn*.”

Cause	Effects			
Student-centered	process mastery role	focus provide teach	participate act advise	efficient exploration mutual
Experiential	knowledge concept	evidence educate	application contribute	observe
Facilitating				

The observation only implies that student-centered strategy is effective because the participants have the chance to discover new ideas and information. It also revealed in the study that student-centered approach with the aid of technology integration; students can access quality learning materials and resources (Chen, 2010). Furthermore, these strategies have shown significant improvement in the satisfaction and academic performance of the student over other teaching strategies (Armbruster, Patel, Johnson, & Weiss, 2009). In support of this student-centered strategy is the experiential learning which has become popular, such learning qualifies the development of knowledge, skills, and attitudes grounded in practice through the use of reflection on action (Parker, Webb, & D'Souza, 1995).

Themes Generated From The Word Tree



Figure 6: Overview of the Word Tree

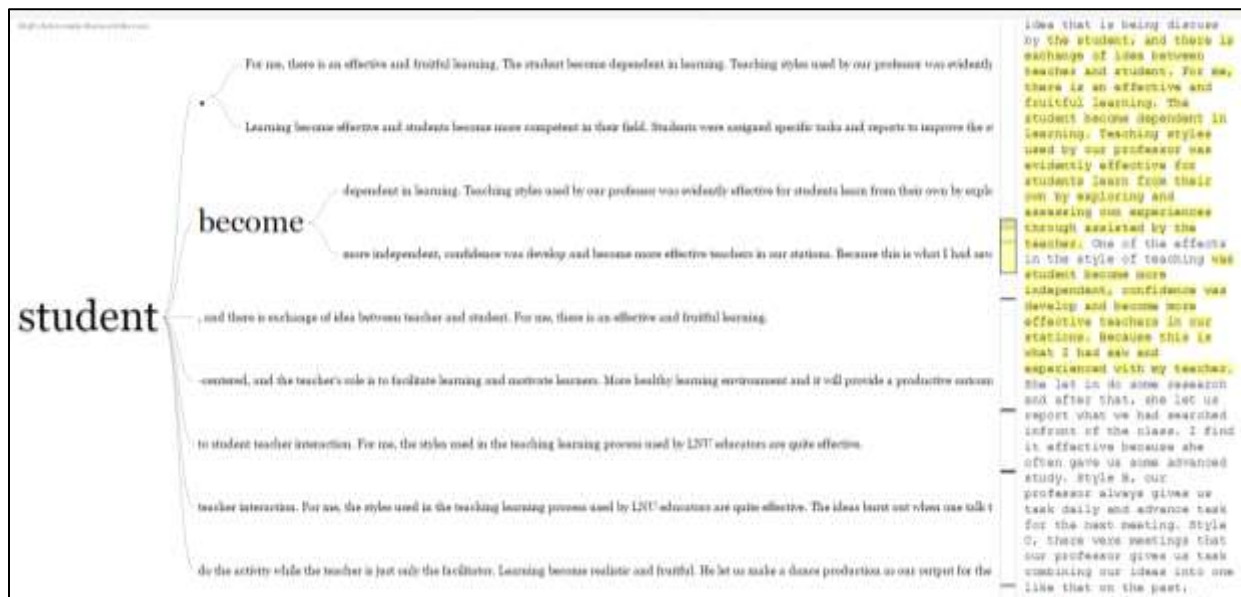


Figure 6.1: Word Tree of the term “student.”



Figure 6.2: Word Tree of the term “teacher.”

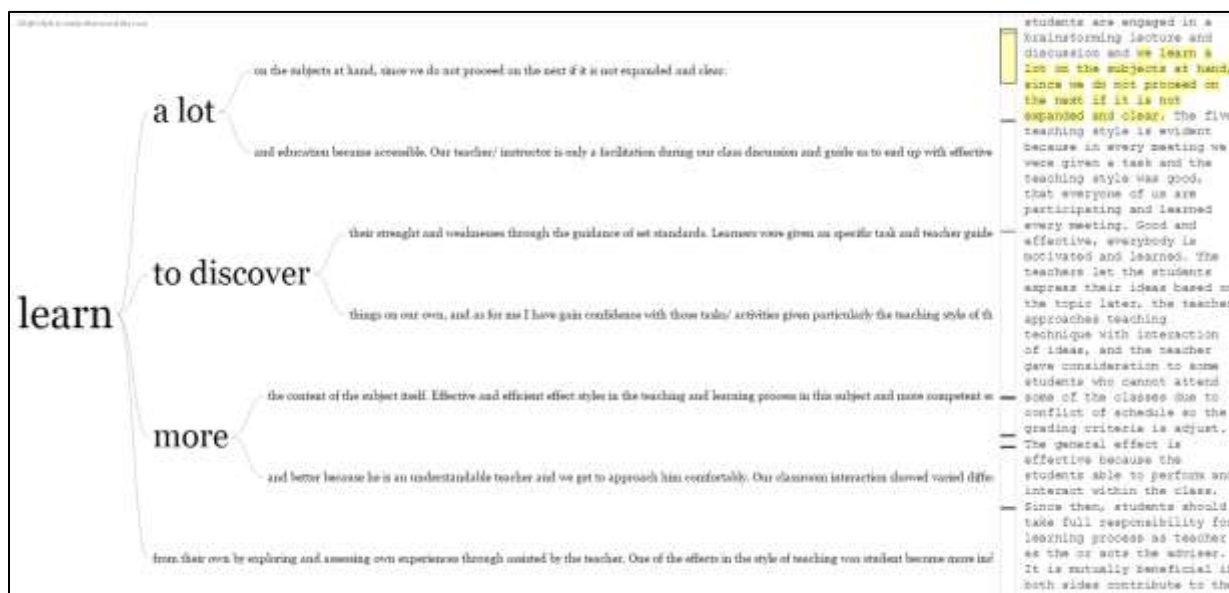


Figure 6.3: Word Tree of the term “learn.”

Word tree is a visual presentation of a qualitative corpus of information and can be applied to show the association of keywords to the sentences from and unstructured qualitative corpus like an interview, narrative, stories, documents, transcriptions from focused group discussions, field notes from an observation and the like. It said in research that tree nodes were retrievable, easily to organize, give flexibility to the researcher in manipulating the qualitative data set (Wong, 2008). Word trees show a pre-selected word(s) and how it is connected to other words in text-based data through a visual branching structure (Wattneberg, & Viegas, 2008). Unlike word clouds, word trees visually display the connection of words in the dataset, providing some context for their use. In this research, word tree was used to visualize the top three (3) keywords-in-text such as student, teacher, and learn. Which conceptual analysis establishes the existence and frequency of concepts in a text. Keyword searching (sometimes referred to as keyword-in-text) involves measuring the frequency of keywords or phrases within a target text or group of target documents (Jones, Shan, & Goodrum, 2010). The process mentioned above was done as a basis to use these three keywords in searching the associated sentences in the text corpus.

As shown above, figure 1 was the overview of the whole text corpus and followed by the word tree generated when the terms were being searched in the text corpus such figure 6.1, 6.2, and 6.3. The yellow highlighted, colored text found at the right side of the figure is the associated sentences. These sentences were then copied and given its meaning and Theme clusters. This process is vital in qualitative research since it aimed to a better understanding of the first-hand experiences, truthful reporting, and quotations of the actual conversation which also sought to understand the participants derived meaning from their surroundings and how their meaning influences their behavior (Ross, 2014). The following presentations were the generated Theme Clusters followed by its Formulated Meanings in bullets.

Table 6: Thematic Map

<u>THEME 1: The Roles of a Teacher</u>	<u>THEME 2: Learning Processes and Strategies</u>	<u>THEME 3: Learning Outcomes</u>
<ul style="list-style-type: none"> • Give guidance and encouragement • Act as facilitator • Provide prescribed tasks or activities • Monitor and evaluate activities • Motivate the learners • Inspire the learners • Serve as a Mentor 	<ul style="list-style-type: none"> • Student-centered teaching • Active learning • Independent learning • Peer-activity learning process • Experiential learning • Influential learning • Classroom interaction • Student-to-Student talk is encouraged • Direct assessment • Set a teaching and learning quality standards • Guided discovery learning 	<ul style="list-style-type: none"> • Developed competent learners • Awareness of time bounded activities • Importance of teacher's guidance • Importance of teaching-learning accessibility • Fruitful learning • Opportunity to: <ul style="list-style-type: none"> ○ Improved competence through self-discovery and motivation ○ Developed self-confidence ○ Expand knowledge ○ Correct given task ○ Share teaching experience

Discussions

THEME 1: The Roles of a Teacher

Evidently, the manifestations of the participants were very clear that the Professors in the graduate program of MPE showed guidance and encouragement to their students. This act of valuing the efforts of the students by recognizing it developed self-confidence and motivation to pursue further (Hillman & Shields, 1975). Among those in guiding students were monitoring their work, inspiring them, and serve as a mentor (Stroet, Opdenakker, & Minnaert, 2013). Among those significant statements describing the role of a teacher in the MPE program were:

"We worked so hard because our professors were very helpful, we got encouraged and were motivated."

"Our teacher act as a facilitator during our class discussion, he guides us up to the end of the class with effective and good ideas."

"We were given a task to have our choreography individually for us to develop talents and skills in dance choreography and given the chance to assess our creation and present it to the class."

These statements were precious in understanding the feelings of the students to develop viable cues to improve student-teacher relationships. Strengthen the relationships creates a bond of sharing ideas, knowledge, and better understanding of the lessons to produce a healthy, conducive, and interactive class.

THEME 2: Learning Processes and Strategies

The Learning process is an important and continuing process. It involves strategies to elicit the students understanding on the subject matter taught in the class.

Their many philosophies about learning processes, even theoretical underpinnings about this like Bandura on social cognitive and Piaget's cognitive development. But it is still the in the perspective, concern, focus on the learners' feelings, understanding wants. Among those statements of the participants were:

"Sometimes, we work or do activities in pairs or as a group where we can share ideas. Thus, relationship with peers is improved."

"Learners were given a specific task and teacher guide the performance of the student, and so, learning becomes effective, and students become more competent in their field."

"Teaching styles used by our professor learned evidently effective for students from their own by exploring and assessing own experiences through assisted by the teacher."

"The effect of this teaching-learning process is that the students are engaged in a brainstorming lecture and discussion, and we learn a lot about the subjects at hand since we do not proceed to the next if it is not expanded and clear."

These manifestations of the participants clearly suggest a practical and conducive learning environment using different teaching strategies called Mosston's spectrum of teaching styles. In a type of teaching style, active learners do not learn much in situations that require them to be passive, and reflective learners do not learn much in situations that provide no opportunity to think about the information presented (Felder & Silverman, 1988). Showing that Graduate Students were active learners considering that they are now professionals and practicing in the teaching industry. As a result, the teaching styles used by their Professors were practical in nature and even the approach in handling the class as seen the in the transcript:

"There is a good retention of knowledge and students are taught the skills well, improved themselves and learn to discover their strength and weaknesses through the guidance of set standards."

In fact in a study, it reveals the importance of socialization context as established between the learners, teachers, and even parents that there was a significant impact on the academic performance, motivation, and behavior of the student (Wentzel, 2002). Socialization in this study has shown a natural effect to the learners by giving them the chance to express by exchanging ideas with its peers and giving them independence to discover things on their own. Among those views of the participants was:

"The teacher listens to the student thoughts, and there is an exchange of views between the teacher and the student. For me, there is an active and efficient learning. The student becomes independent in learning."

As Shulman (1987) suggests, knowledge and teaching as a foundation of new reform, says, professional improvement based their arguments on the belief that there exists a "knowledge base for teaching." A codified or codifiable aggregation of knowledge, skills, understanding, and technology, of ethics and disposition, of collective responsibility – as well as a, means of representing and communicating it. When teachers listen and give challenging activities to their students and student's actively participating to it gives a new enlightenment and knowledge in teaching strategies and management. The style of instruction is a phrase sometimes used to describe different things (Heimlich & Norland, 2002), which most researchers who have defined teaching style refer to the style as a predilection toward teaching behavior and the congruence between educator's teaching practices and teaching beliefs (Heimlich & Norland, 1994).

THEME 3: Learning Outcomes

The learning outcomes as manifested by the participants as shown in Theme 3 focused on the independent learning and guidance from the Professors. It is inevitable say independent learning with Professor's guidance is the most practiced in the graduate school or advanced studies. Prescribed task was given to the students to learn on their own by conducting research studies like action research. Among those views of the participants were:

"We learn to discover things on our own, and as for me, I have gained confidence with those tasks/activities given particularly the teaching style of the teacher."

"The learning becomes active, and students become more competent in their field. Students were assigned specific tasks and reports to improve the student's knowledge about the topic."

"Learners were given a particular task and teacher guide the performance of the student. The learning becomes active, and students become more competent in their field."

"For me, there is an effective and fruitful learning. The student becomes independent in learning".

The importance of independent learning with guidance strategy expand the knowledge of the learner. Knowledge is first conceptualized, abstracted and then understood and studied by the student (Cairncross & Mannion, 2001). The student's conceptions of this new knowledge, then need to be used and tested in meaningful activities, which may lead to initial beliefs being verified or negated. In either event, the effect needs to be considered through internal or external dialogue, which in turn contributes to the new knowledge either absorbed into existing schemata or existing schemata being adapted to integrate the new knowledge. As a result, they will have the opportunity to improve competence through self-discovery and motivation, developed self-confidence, expand knowledge, correct given task, and share teaching experience. In fact, many studies agreed about the positive outcomes and advantages of independent learning, among those were students positively favoring their particular learning style, and that it offered greater flexibility, enabling them to choose where and when they studied (Dewhurst, Macleod, & Norris, 2000).

5.0 Conclusion

It is empirical to say based on the results of this study that Graduate Students specifically those enrolled in the MPE program has positive sentiments on the different kinds of teaching styles used by their Professors. Moreover, it was manifested in their views through Themes such as *the Roles of a Teacher* like give guidance and encouragement, act as a facilitator, provide prescribed tasks or activities, monitor and evaluate activities, motivate the learners, inspire the students, and serve as a Mentor. *Learning processes and strategies* used by the Professors like Student-centered teaching, active learning, independent learning, peer-activity learning process, experiential learning, influential learning, classroom interaction, student-to-student talk is encouraged, direct assessment, set a teaching and learning quality standards, and guided discovery learning. Finally, *Learning Outcomes* like developed competent learners, awareness of time bounded activities, the importance of teacher's guidance, the importance of teaching-learning accessibility, fruitful learning, and opportunity to improved competence through self-discovery and motivation, developed self-confidence, expand knowledge, correct given task, and share teaching experience.

These findings only suggest and provide inputs on what the graduate students think of about their lived experiences both professional and academic on the different teaching styles used by their Professors.

6.0 References

- Aristotle on causality - Create Advantage. (n.d.). Retrieved from <http://www.createadvantage.com/glossary/aristotle-causality>
- Armbruster, P., Patel, M., Johnson, E., & Weiss, M. (2009). Active learning and student-centered pedagogy improve student attitudes and performance in introductory biology. *CBE-Life Sciences Education*, 8(3), 203-213.
- Cairncross, S., & Mannion, M. (2001). Interactive multimedia and learning: Realizing the benefits. *Innovations in education and teaching international*, 38(2), 156-164.
- Characteristics of Effective Teachers. (ND). *Characteristics of Effective Teachers*. Stanford Teaching Commons. Stanford University. Retrieved from <https://teachingcommons.stanford.edu/resources/teaching/planning-your-approach/characteristics-effective-teachers>
- Chen, R. J. (2010). Investigating models for preservice teachers' use of technology to support student-centered learning. *Computers & Education*, 55(1), 32-42.
- Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Creswell, J. W., & Clark, V. L. P. (2007). *Designing and conducting mixed methods research*.
- Crosnoe, R., Johnson, M. K., & Elder, G. H. (2004). Intergenerational bonding in school: The behavioral and contextual correlates of student-teacher relationships. *Sociology of education*, 77(1), 60-81.
- Dewhurst, D. G., Macleod, H. A., & Norris, T. A. (2000). Independent student learning aided by computers: an acceptable alternative to lectures?. *Computers & Education*, 35(3), 223-241.
- Effective Teacher Traits. (ND). *Effective Teacher Traits*. Gordon College Website. Retrieved from <http://www.gordon.edu/teachertraits>
- Falcon, A. (2008). Aristotle on causality. Retrieved from <http://philpapers.org/rec/FALAOC>
- Felder, R. M., & Silverman, L. K. (1988). Learning and teaching styles in engineering education. *Engineering education*, 78(7), 674-681.
- Forsetlund, L., Bjorndal, A., Rashidian, A., Jamtvedt, G., O'Brien, M. A., Wolf, F., ... & Oxman, A. D. (2009). Continuing education meetings and workshops: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev*, 2(2).

- Hamre, B. K., & Pianta, R. C. (2006). *Student-Teacher Relationships*. Retrieved from <http://psycnet.apa.org/index.cfm?fa=search.displayRecord&UID=2006-03571-005>
- Heimlich, J. E., & Norland, E. (1994). *Developing Teaching Style in Adult Education. The Jossey-Bass Higher and Adult Education Series*. Jossey-Bass, Publishers, 350 Sansome Street, San Francisco, CA 94104..
- Heimlich, J. E., & Norland, E. (2002). Teaching style: Where are we now?..*New directions for adult and continuing education*, 2002(93), 17-26.
- Hillman, B. W., & Shields, F. L. (1975). The encouragement process in guidance: Its effect on school achievement and attending behavior. *The School Counselor*, 22(3), 166-173.
- Hodgkinson, G. P., Johnson, G., Whittington, R., & Schwarz, M. (2005). *The Role and Importance of Strategy Workshops*. Findings of a UK Survey.
- Hsieh, S. W., Jang, Y. R., Hwang, G. J., & Chen, N. S. (2011). Effects of teaching and learning styles on students' reflection levels for ubiquitous learning. *Computers & Education*, 57(1), 1194-1201.
- Hughes, J., & Kwok, O. M. (2007). Influence of student-teacher and parent-teacher relationships on lower achieving readers' engagement and achievement in the primary grades. *Journal of educational psychology*, 99(1), 39.
- Jones, T., Shan, Y., & Goodrum, P. M. (2010). An investigation of corporate approaches to sustainability in the US engineering and construction industry. *Construction Management and Economics*, 28(9), 971-983.
- Las Johansen, B. C., Diaz, M. V. A., & Gabon, R. (2015). The Use of Teaching Styles In Physical Education Perceived by Graduate Students. *International Journal of Education and Research*, 3(3). Retrieved from <http://www.ijern.com/journal/2015/March-2015/29.pdf>
- Lai, H. J. (2010). Secondary school teachers' perceptions of interactive whiteboard training workshops: A case study from Taiwan. *Australasian journal of educational technology*, 26(4), 511-522.
- Matsumoto, Y., & Watada, J. (2015). Rough Set Model-Based Knowledge Acquisition of Market Movements from Economic Data. In *Information Granularity, Big Data, and Computational Intelligence* (pp. 375-388). Springer International Publishing.
- O'Dwyer, S. (2006). The English teacher as facilitator and authority. *TESL-EJ*, 9(4), 1-15.
- Parker, D. L., Webb, J., & D'Souza, B. (1995). The value of critical incident analysis as an educational tool and its relationship to experiential learning. *Nurse Education Today*, 15(2), 111-116.
- Patil, T. R., & Sherekar, S. S. (2013). Performance analysis of Naive Bayes and J48 classification algorithm for data classification. *International Journal of Computer Science and Applications*, 6(2), 256-261.
- Pawlak, Z. (1998). Rough set theory and its applications to data analysis. *Cybernetics & Systems*, 29(7), 661-688.
- Ray, W. J. (2012). *Evolutionary Psychology: Neuroscience Perspectives concerning Human Behavior and Experience: Neuroscience Perspectives concerning Human Behavior and Experience*. SAGE Publications.
- Ross, J. (2014). Participatory Observation. Retrieved from <https://web.csulb.edu/~msaintg/ppa696/696quali.htm>
- Semantic [Def. 1]. (ND). *Merriam-Webster Dictionary Online*. Merriam-Webster. Retrieved 2/12/2016 from <http://www.merriam-webster.com/dictionary/semantic>
- Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard educational review*, 57(1), 1-23.
- Sinclair, S. and G. Rockwell (2015). Collocate Clusters. Voyant. Retrieved 11/24/2015 from <http://voyant-tools.org/tool/Links/>
- Stroet, K., Opdenakker, M. C., & Minnaert, A. (2013). Effects of need supportive teaching on early adolescents' motivation and engagement: A review of the literature. *Educational Research Review*, 9, 65-87.
- Wattneberg, M. & Viegas, F. B. (2008). *The word tree, an interactive visual concordance*. InfoVis. http://hint.fm/papers/wordtree_final2.pdf
- Wentzel, K. R. (2002). Are effective teachers like good parents? Teaching styles and student adjustment in early adolescence. *Child development*, 73(1), 287-301.
- Williams, G. (2014). Data Science with R Text Mining. Retrieved from <http://handsondatascience.com/TextMiningO.pdf>
- Wong, L. P. (2008). DATA ANALYSIS IN QUALITATIVE RESEARCH: A BRIEF GUIDE TO USING NVIVO. *Malaysian Family Physician*, 3(1).
- Word Association [def. 2] (2016). Retrieved from <http://dictionary.cambridge.org/dictionary/english/word-association>
- Word Association Lookup [def. 1]. (2016). Retrieved from <http://wordassociations.net/>
- Word association在《劍橋英語詞典》中的解釋及翻譯. (n.d.). Retrieved from <http://dictionary.cambridge.org/zht/詞典/英語/word-association>
- Yahya, S., Ahmad, E. A., & Jalil, K. A. (2010). The definition and characteristics of ubiquitous learning: A discussion. *International Journal of Education and Development using Information and Communication Technology*, 6(1), 1.