

Why Enroll in a Graduate-level Vocational Education Program?: Exploring Views of Graduate Students Using Latent Dirichlet Allocation Topic Modelling

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Abstract: Why Enroll in a Graduate-level Vocational Education Program? : Exploring Views of Graduate Students Using Latent Dirichlet Allocation Topic Modelling. Objectives: The main objective of this study was to identify the most frequent words, the sentiment, and the underlying themes in the students' responses regarding their enrollment in a graduate-level vocational education program. **Methods:** Word Cloud generation, VADER Sentiment Analysis and Latent Dirichlet Topic modelling were utilized to analyze the collected data. **Findings:** The most frequent words in the responses of students were "promotion", "personal", "development", "future", "possible", "knowledge", and "career". The sentiment analysis showed a positive overall polarity of 0.477 with no negative sentiment. The themes that emerged from the analysis were the desire for increased knowledge in vocational education, the requirement for a graduate degree, and the desire for career promotion. The findings provide insights into the needs and expectations of students and can be used by institutions to design programs and improve the educational experience of students.

Keywords: vocational education, sentiment analysis, graduate student, topic modelling.

Abstrak: Mengapa Mendaftar di Program Pendidikan Kejuruan Tingkat Pascasarjana? : Menjelajahi Pandangan Mahasiswa Pascasarjana Menggunakan Latent Dirichlet Allocation Topic Modelling. Tujuan: Tujuan utama dari penelitian ini adalah untuk mengidentifikasi kata-kata yang paling sering muncul, sentimen, dan tema yang mendasari tanggapan siswa mengenai pendaftaran mereka di program pendidikan kejuruan tingkat pascasarjana. **Metode:** Pembuatan Word Cloud, Analisis Sentimen VADER, dan pemodelan Topik Dirichlet Laten digunakan untuk menganalisis data yang dikumpulkan. **Temuan:** Kata-kata yang paling sering muncul dalam tanggapan siswa adalah "promosi", "pribadi", "pengembangan", "masa depan", "mungkin", "pengetahuan", dan "karir". Analisis sentimen menunjukkan polaritas keseluruhan positif sebesar 0,477 tanpa sentimen negatif. Tema yang muncul dari analisis tersebut adalah keinginan untuk meningkatkan pengetahuan dalam pendidikan kejuruan, persyaratan untuk mendapatkan gelar sarjana, dan keinginan untuk promosi karir. Temuan ini memberikan wawasan tentang kebutuhan dan harapan siswa dan dapat digunakan oleh institusi untuk merancang program dan meningkatkan pengalaman pendidikan siswa.

Kata kunci: pendidikan vokasi, analisis sentimen, mahasiswa pascasarjana, pemodelan topik.

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■ INTRODUCTION

Despite the current strong job market with low unemployment, competition for top positions remains intense. For example, technology companies receive millions of job applications each year, while other industries receive thousands. Employers are increasingly placing importance on soft skills such as emotional intelligence, resilience, and ability to learn, but many of the most sought after jobs still require a graduate degree. As more people attend university, the value of an undergraduate degree has decreased, leading to an increase in the number of people considering pursuing a graduate degree (Chamorro-Premuzic, 2020). Graduate education offers students various opportunities to engage in meaningful learning experiences and develop into socially responsible professionals (Choi and Choi, 2020). Winkler (2020) explains that attending graduate school can have numerous positive impacts on an individual's life, covering professional, personal, and social aspects. A graduate degree can build credibility, set you apart from peers, offer career change opportunities, provide opportunities for networking, and deepen your knowledge and skills in your field. These benefits, along with pay increases and improved critical thinking skills, make earning a graduate degree a valuable investment in one's future. For educators and future educators, earning a graduate degree in education is a great way to stay at the forefront of the field and have a significant impact one's life. There are many paths to choose from, and the degree will prepare you to effectively teach and adapt to a changing society. The master's program goes beyond a traditional bachelor's degree by offering real-life experiences and allowing for the development of deep knowledge in the workplace. The curriculum often includes leadership courses as many graduates will work for government institutions. Pursuing a graduate degree in

education is an opportunity to immerse yourself in a subject you are passionate about (Ssebikindu, 2021).

With the many benefits of taking a graduate degree program, there has been a dearth and steady decline of enrollees in vocational degree programs especially in the graduate level (OPRKM-Knowledge Management Division, 2019). The negative notion of vocational education is explained by Ambag and Bernarte (2018) who conducted a study where according to the participants interviewed, before enrolling in technical vocational education (TechVoc), the prevailing mentality was that TechVoc wasn't necessary. Many of the participants were uninformed about TechVoc because their main focus was obtaining a degree, as society viewed this as a guaranteed path to employment. They believed that having a degree was superior to enrolling in a TechVoc program. The participants also believed that TechVoc education was only for individuals who couldn't afford to attend higher education. Most of them held a negative perception of Technical Vocational Education. To understand the underlying perceptions of graduate student taking up a graduate degree vocational education, this research aimed to collect responses from graduate students of Master of Arts in Teaching Vocational Education (MATVE) and determine the over-all polarity of their sentiments through sentiment analysis and obtain topic models using Latent Dirichlet Allocation Algorithm.

■ METHODS

Participants

The study was based on data collected from 20 MATVE students who were asked about their reasons for enrolling in a vocational graduate degree program. The participants' responses were analyzed to gain insight into their perceptions and uncover themes in their answers.

Research Design

The researcher adopted an exploratory sequential design, using a corpus composed of responses from graduate level student of vocational education. This design, according to Creswell (2017), involves first gathering and analyzing qualitative data, followed by the construction of a method or instrument that is tested quantitatively, based on the opinions of the participants. The aim of an exploratory design is to develop and utilize new variables, surveys, interventions, digital tools, or quantitative measures that are grounded in qualitative data.

The study relied on content analysis and relational analysis (Semantic analysis) to address the research questions, and it was strengthened by a priori examination of concepts. The study also employed systematic procedures for gathering qualitative information from the participants, processing the information, and forming themes. Theme validation was used to uncover hidden information within the corpus of text. The same methodology was used in the study of Casillano (2021).

Data Analysis

Text Processing and Cleaning

A set of open-ended questions were sent to students of the MATVE program, with the responses remaining anonymous and stored in an excel sheet. To comply with the Data Privacy Act of 2012, the form included a data privacy notice on confidentiality. The responses will be processed using Orange Data Mining Software and undergo text preprocessing and cleaning, including stopwords removal, stemming, and term frequency-inverse document frequency calculation. Stopwords removal eliminates common words that don't contribute significantly to the meaning of the text, while stemming identifies the root of a word. The TF-IDF score assesses the importance of a word in a collection

of documents. These preprocessing methods simplify the text and make it easier for analysts to process (Vijayarani, Ilamathi & Nithya, 2015).

Valence Aware Dictionary and sEntiment Reasoner

VADER (Valence Aware Dictionary and sEntiment Reasoner) is a lexicon-based sentiment analysis tool that is specifically attuned to sentiments expressed in social media. It is a rule-based method that uses a set of sentiment-related words (positive, negative, and neutral) along with their contextual meaning to determine the sentiment of a given text. VADER is designed to be quick and effective, with a high accuracy rate, and takes into account both the polarity (positive or negative) and the intensity (degree) of the sentiment expressed in the text. It is commonly used in NLP and text mining tasks to determine the sentiment expressed in social media posts, customer reviews, and other unstructured text data.

Latent Dirichlet Allocation

As explained by Bansal (2020), Latent Dirichlet Allocation (LDA) is a technique used in topic modeling to categorize text within a document into specific topics. It leverages the Dirichlet distribution to identify the topics in each document and the words associated with each topic. The Dirichlet distribution was named after Johann Peter Gustav Lejeune Dirichlet, a 19th century German mathematician who made extensive contributions to mathematics. Latent Dirichlet Allocation is a method of assigning sentences to topics. It identifies specific groups of topics based on inputs and undergoes several processes before generating the final topics. There are certain rules and assumptions that are considered prior to using LDA for topic modeling. These assumptions are: documents with similar subjects contain similar groups of words, latent

topics can be detected by searching for word clusters that frequently appear together in documents throughout the corpus, and documents are considered to be probability distributions over latent topics, meaning that certain documents may contain a higher concentration of words from a specific topic. Additionally, topics themselves are considered to be probability distributions over words.

The LDA algorithm is used to discover a set number of K topics within a given dataset or group of documents. The algorithm works by randomly assigning each word in each document to one of the K topics, providing both topic representations for all documents and word distributions for all topics. Despite this initial assignment, the representation of topics generated by the LDA algorithm is not always accurate, so a formula is created to improve the results and streamline the process.

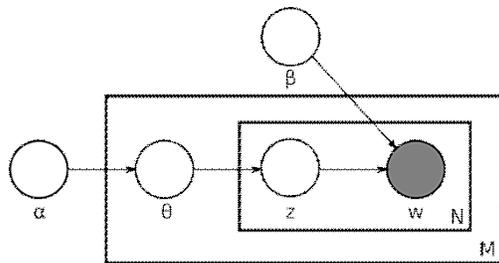


Figure 1. Plate Notation representing LDA model (Bansal, 2020)

- M denotes the number of documents
- N is number of words in a given document
- á is the parameter of the Dirichlet prior on the per-document topic distributions
- â is the parameter of the Dirichlet prior on the per-topic word distribution
- theta is the topic distribution for document i
- varphi is the word distribution for topic k
- z is the topic for the j-th word in document i
- w is the specific word.

$$p(\beta_{1:K}, \theta_{1:D}, z_{1:D}, w_{1:D}) = \prod_{i=1}^K p(\beta_i) \prod_{i=1}^D p(\theta_d) \left(\prod_{n=1}^N p(z_{d,n} | \theta_d) p(w_{d,n} | \beta_{1:K}, z_{d,n}) \right)$$

Figure 2. LDA formula - gibbs sampling (bansal, 2020)

For every word in every document and for each Topic T we calculate: $P(\text{Topic } T | \text{Document } D)$ = the proportion of words in document d that are currently assign to topic T. $P(\text{Word } W | \text{Topic } T)$ = the proportion of assignments to topic T over all documents that come from this word W. Reassign w to a new topic where we choose Topic T with probability $P(\text{Topic } T | \text{Document } D) * P(\text{Word } W | \text{Topic } T)$. This is essentially Topic T generated word w

Data Interpretation

The researchers aim to present a comprehensive analysis of the results by addressing gaps in the introduction and delving into the reasons behind the observed results. The discussion will suggest potential solutions to the phenomena revealed while striving to provide a thorough explanation of the findings.

Tools and Software

The study will use Orange Data Mining Software, which is an open-source machine learning and data visualization software that offers a visually appealing and user-friendly interface for creating data analysis workflows. With its diverse range of tools and features, Orange enables the creation of data analysis workflows.

Ethical Considerations and Reflexivity

Conducting research involving individuals requires strict adherence to ethical standards. To maintain the confidentiality and privacy of the

MATVE program. A compound mean score of 0.447 was also obtained which means that the overall sentiment for the collection of responses is positive. It is worth noting that the sentiment analysis result did not generate or tag any negative responses from the participant. To further visualize the sentiment analysis result, a heat map was generated. Figure 4 elucidates the result of the sentiment analysis. Khan (2022) mentioned that the popularity of data visualization techniques such as heat maps is due to the fact that humans are inherently visual beings. Numerous studies on human psychology and perception have demonstrated that humans are able to comprehend and interpret visual information much more efficiently than written text or data. It shows a spectrum of color from dark blue which

represent 0 (neutral) to white being highly positive. It is clear in the compound column of the heat map that most of the responses were positive showing colors from light blue to light yellow. The positive attitude of students is explained by Ingram et al. (2000) who applied the theory of planned behavior to determine the influence of attitudes, subjective norms, and perceived behavioral control on college students' intentions and actions regarding graduate school admission. They found that these factors are interrelated and contribute to predicting a student's intention to attend graduate school. Those with positive attitudes towards graduate school, support from their social network, and a sense of control over the admission process are more likely to pursue graduate school (Shellhouse et al., 2020).

Table 1. Sentiment analysis score

Student	Positive	Negative	Neutral	Compound
Student1	0.065	0	0.935	0.4902
Student2	0.038	0	0.962	0.0772
Student3	0.388	0	0.612	0.6908
Student4	0.288	0	0.712	0.963
Student5	0.18	0	0.82	0.8976
Student6	0.08	0	0.92	0.5095
Student7	0	0	1	0
Student8	0	0	1	0
Student9	0.228	0	0.772	0.9349
Student10	0	0	1	0
Student11	0	0	1	0
Student12	0.113	0	0.887	0.6808
Student13	0.185	0	0.815	0.7717
Student14	0.276	0	0.724	0.872
Student15	0.18	0	0.82	0.8976
Student16	0.08	0	0.92	0.5095
Student17	0	0	1	0
Student18	0.051	0	0.949	0.3182
Student19	0	0	1	0
Student20	0.051	0	0.949	0.3182
Mean Compound Score: 0.44656				
Interpretation: Positive				

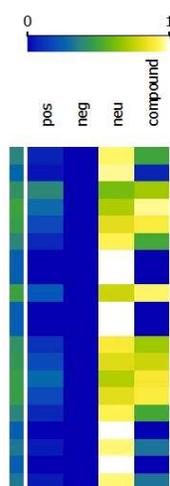


Figure 4. Heat map

Topic Models

The responses of participants were fed to a topic modelling algorithm which generated three (3) themes or topic labels. It can be gleaned in table 2 that LDA generated 10 keywords which were then interpreted by the researcher to generate the appropriate theme. The same methodology was applied by Cuaton et al. (2020) and Alburo et al. (2021).

Increase knowledge in Vocational Education

This theme is in consonance with the article of Harrison (2021), which explains that obtaining

Table 2. topic models generated

Topic No.	Keywords	Theme/Topic Label
1	knowledge, improve, develop, adept, different, methods, tvl, technical, would, help	Increase knowledge in Vocational Education
2	mandatory, studies, item, permanent, score, ranking, vertical, ict, work, reason	Graduate degree as a mandatory requirement
3	career, done, promotion, need, growth, develop, purposes, work, future, job	Graduate degree as main driver for promotion

a master's degree provides a deeper understanding of one's chosen field and career, adding credibility and expertise to their resume. This increased knowledge can give a competitive edge in the job market, as employers increasingly require higher levels of education. Pursuing a master's degree also offers opportunities for professional and personal growth, including building valuable connections, developing necessary skills, and keeping up with technological advancements. Committing to ongoing learning can enhance not only one's

professional development but also their employability and overall well-being. The attitude of seeking more training and knowledge in vocational education has been highlighted in the research of Carruthers & Jepsen (2021), which mentioned that students who were randomly selected or had equal chances to attend a vocational school showed higher graduation rates and early career earnings compared to those who did not. According to Kreisman and Stange (2020), students who took advantage of the opportunity to deepen their knowledge in a

particular career and technical program appeared to benefit. Teachers who plan to pursue a teaching career in vocational education must improve their skills and knowledge base because according to Said (2018) vocational technology students desire a teaching style that connects theoretical concepts to real-world applications, in preparation for their future careers. They have a low preference for traditional lecture-style teaching, including conventional presentations.

Student 2: "MATVE help to enhance my knowledge, skills and ability that I will applied in my job because skills are one of the major factors that play a very important role in choosing a career"

Student 9: "To expand knowledge of the fields related to the current areas of professional specialization and to enhance my personal and professional development"

Graduate degree as a mandatory requirement

The quality of education is heavily dependent on the credentials, skills, and proficiency of the faculty (Tulo and Lee, 2022). Recognizing the crucial role educators play in ensuring positive educational outcomes, the Philippine Commission on Higher Education (CHED) requires that higher education faculty hold at least a master's degree in their area of specialization, as outlined in CMO No. 52, s. 2007. This mandate has been reiterated in the DBM-CHED Joint Circular no. 1 series of 2022 released both by the Commission on Higher Education and the Department of budget and management mentioning that a master's degree is required to be eligible for promotion (DBM-CHED, 2022). In instances where there is a shortage of qualified faculty members, temporary appointments may be made, but these can only be renewed five times and must be fulfilled with the required master's degree within a year, according to the Civil Service Commission

(2016). Furthermore, the educators who want to be promoted to Master Teacher positions, in the Philippine Department of Education, is required to obtain a masters degree.

Student 15: "I enrolled in MATVE ICT because first is that we are obliged by the school to finish our Graduate studies as soon as possible because of it being a requirement"

Student 20: "Aside from obtaining a technical bachelors degree, finishing a masters degree in vocational education is mandatory for be to be permanent"

Graduate degree as main driver for promotion

A plethora of researches concur to the theme of graduate degree as main driver for promotion. In a study conducted by Alabas et al., (2012), the authors found that postgraduate education was pursued by teachers for both professional growth and personal development. The master's degree students placed more importance on advancing their careers and receiving higher compensation. They can regularly reflect on their initial motivations for starting the program, which should serve as a source of inspiration and drive to persist and complete the degree requirements (Teowkul et al., 2009). Holders of a master's degree are more likely to secure senior roles with relevant work experience (Nucum, 2019). A study conducted by Entrepreneur.ph in collaboration with Jobstreet.com found that employees with postgraduate degrees earned 73% more than those with just a college degree. As a result, obtaining a master's degree can significantly boost one's earning potential (Subido, 2017). According to Cruz and Ramirez (2016), the desire for promotion and upgrading of qualifications were strong motivators for individuals to pursue graduate studies, as well as opportunities to teach in higher education programs or work for a high-paying company.

Student 3: "I enrolled MATVE for professional and career growth and for promotion purposes as well"

Student 7: "For career development, promotion and ultimately for be to obtain a permanent teaching status"

■ CONCLUSIONS

It has been established that there is a dearth and a decline of enrollees in graduate level vocational education programs, however to continually improve and understand the prevailing reasons why student enroll in the Master of Arts in Vocational Education degree program, this research was conducted. Based on the word cloud generated, the most frequently used words were promotion, personal, development, future, possible, knowledge and career. The sentiment analysis resulted to an overall polarity of 0.477 interpreted as positive and recorded no negative sentiment. Themes that emerged during the topic modelling process were increase knowledge in vocational education, graduate degree as a mandatory requirement, and graduate degree as main driver for promotion. Findings of this research provided insights into the needs and expectations of students. These can be utilized by institutions to design programs that meet those needs and provide a positive educational experience to students. Sentiments and themes generated can help institutions to identify potential challenges and provide support to ensure student success and reduce dropout rates. And, ultimately, knowing the motivations of prospective students can inform recruitment and marketing strategies, allowing institutions to attract and retain students who are more likely to succeed.

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