Thematic Analysis of Students' Perception and Attitudes towards Online Class using Latent Dirichlet Allocation

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***Abstract*—The Latent Dirichlet Allocation (LDA) topic model is employed for the purpose of categorizing textual content within a document into specific topics. The objective of this study is to construct a model that identifies themes related to students' perceptions and attitudes towards the deployment of online classes. This was achieved by analyzing data collected from students at CSPC who are now experiencing the effects of the epidemic. The participants of the study were restricted to those who were currently enrolled as students in Polytechnic Colleges located in the province of Camarines Sur. Data collection was conducted through the utilization of questionnaires, which were distributed to the students via Google Forms. The present study employed a qualitative research design. The efficacy of the LDA algorithm in topic or theme identification was observed by the researchers. The utilization of coherence score and perplexity proved to be a dependable approach for testing the model. The visual depiction of the themes effectively highlights the significant keywords associated with each issue and yields favourable outcomes that accurately portray the extracted topics about the sentiments of the pupils. The selection of the topic name and the subsequent interpretation effectively elucidated the significance of each respective issue.**

***Index Terms*—Thematic Analysis, Topic Modelling, Latent Dirichlet Allocation, Student's Perception and Attitude**

I. Introduction

Distance learning was the only way for colleges all around the world to restart lessons during the Covid-19 outbreak. Despite the daily hardships with limited access to electronic learning resources and potential health issues, students experienced bewilderment, loneliness, and uncertainty about what would happen with classes and other relevant activities that affected students' academic course [1]. Many students, in particular, find college to be a tough experience. However, sudden changes occurred to adjust to the new normal education due to the pandemic. Tertiary Education has changed and shifted to online learning which has brought overwhelming pressure to students. Due to the COVID-19 epidemic, education systems were forced to convert from face-to-face to online learning amid the semester. If not executed appropriately, this paradigm shift in education restricts students' ability to absorb and process knowledge. Integrating learning modes for successful teaching and learning may merely result in cognitive overload, limiting students' ability to acquire new material effectively. In a recent study by Bali and Liu, students' views on online and face-to-face learning were investigated (2018). Students' learning perspectives were examined in online and face-to-face groups to see how they differed based on the course delivery style and online environment [1]. According to the conclusions, face-to-face learning is favored over online learning in terms of social presence, social engagement, and enjoyment. On the other hand, other students liked online learning since it allowed them to be creative while employing computer technology. Students' views about online and face-to-face learning were explored in a recent study by Bali and Liu (2018). The study examined student learning views in online and face-to-face groups to determine how they changed based on the course delivery mode and online environment. Face-to-face learning is favored over online learning in terms of social presence, social engagement, and enjoyment, according to the findings of this study [2]. However, there were no statistically significant variations in learning preferences among student levels. Other students, on the other hand, liked online learning since it allowed them to be creative while employing computer technology. The Camarines Sur Polytechnic Colleges is one of the SUCs that has made the switch to online learning. The instructor used a variety of online learning resources during the teaching and learning process. Google Meet was used to conduct online synchronous classes. While CSPC

Learning Online Space (LeOns), a Moodle-based Learning Management System of CSPC, was utilized as a learning management portal where instructors may post their learning materials and activities. Due to sudden transition to online modalities, students are among those who are affected. The goal of this research is to learn what CSPC students felt about the current online learning, their perceptions and attitudes. Using an online questionnaire, students was invited to reply to open-ended questions. Important insights and topics then was generated using thematic analysis using topic modeling. In the study of Jelodar et al (2019), They utilized LDA to look at highly academic articles about subject modeling from 2011 to 2016 to understand the field's research progress, current trends, and intellectual structure. Topic models play an important part in text mining in computer science. The study focuses on a list of words that appear in statistically significant approaches [8]. Topic models are unable to grasp the meanings and concepts of words in text documents when used for topic modeling. Instead, they believe that any portion of the text is put together by selecting words from a variety of word baskets, each of which has a different subject. Topic modeling can provide you with a bird's-eye view of a large collection, encompassing the whole collection, individual documents, and connections between them. Topic modeling is a sort of statistical modeling that is used to find the abstract "topics" that appear in a set of documents. The topic model Latent Dirichlet Allocation (LDA) is used to classify text in a document to a certain topic. In connection with this, the study aims to develop a model that determines themes for the students' sentiments on perception and attitude regarding the implementation of online class using the data provided by the CSPC students who are amid pandemic.

II. Review of Related Studies

To obtain a comprehensive knowledge of the study conducted, the researchers analyze various published works of literature related to the subject and give a review by topic.

A. Online Learning Implementation

Because of the global pandemic, several educational institutions have suspended academic activities and courses. COVID-19 is a virus that may easily infiltrate the immune system, making people who are afflicted more vulnerable. Schools and instructors are attempting to embrace digital learning material to create a more effective and relevant learning environment. E-learning is used to maximize the learning process even when there are no face-to-face meetings. This learning technique is an alternative to more standard teaching methods. Learning media and systems are beginning to move from traditional learning to the most recent learning technique by employing technological help. As a result of the new learning technique's widespread acceptance, several academics have chosen to conduct a study to evaluate the online learning process and the problems that students encounter. With the continuing Covid-19 epidemic as a backdrop, in the study of Febrianto et. al (2020) their findings was, not all students like online learning, with some expressing unhappiness with its efficacy. Due to social, economic, and cultural difficulties, online education has been unable to be implemented effectively in several Indonesian locations. Virtual learning on Madura Island is constrained not only by technology difficulties and facilities but also by the human resources that must be pushed to adopt new learning paradigms. Students think that this learning technique is ineffective due to a variety of obstacles, including physical proximity. As a result, supportive facilities and infrastructure, as well as facilitated internet access in distant areas, financial help, and public awareness of the importance of online learning are all necessary. Reyes-Chua et al (2020), on the other hand, analyze the condition of the E-Learning classroom implementation in selected HEIs in Region IV-A using a qualitative method and a survey questionnaire to a small sample of professionals who have been teaching various courses at the tertiary level. According to the findings, respondents had a favorable experience using the E-learning classroom as a rapid solution to the country's growing quarantine problem. Although all of the respondents' E-learning platforms are free, students have complained about a lack of resources, difficulty connecting to Wi-Fi, and a lack of training among students and faculty members[16]. To meet the Commission on Higher Education's mandated number of hours, this research suggests professional development workshops for both teachers and students, as well as the production of advanced lectures, slide presentations, and tests per unit (CHED). Effective online teaching, according to Hodges et al. (2020), is the result of decades of study into instructional design and planning. Despite this, the COVID-19 pandemic prompted many students throughout the world to transition from face-to-face teaching to an online learning environment in the middle of the semester[21]. Students' ability to process information is limited, and combining learning techniques might result in cognitive overload, impairing students' ability to learn new material effectively. Furthermore, if students do not have faith in the technology they are using or do not feel academically motivated or socially connected, their learning outcomes may be significantly harmed. Bowering (2019). Rasmitadila et al, during the COVID-19 Pandemic, a program called School from Home was established in Indonesia, and the study investigates primary school teachers' opinions of online learning. Data was gathered through questionnaires and semi-structured interviews with 67 primary school teachers. This study adds to the growing body of knowledge about how online collaborative learning between instructors, parents, and schools affects student achievement [15]. In general, the readiness of technology in line with the national humanist curriculum, as well as support and collaboration from all stakeholders, including the government, schools, teachers, parents, and the community, determined the success of online learning in Indonesia during the COVID-19 Pandemic. Furthermore, the shutdown of educational activities in the Kingdom of Saudi Arabia as a result of the ongoing COVID-19 epidemic led to an unexpected move away from conventional learning and toward a system that only relies on digital teaching and

learning. According to Khalil R., in their study at Unaizah College of Medicine and Medical Sciences, Qassim University, Saudi Arabia, they investigated medical students' opinions of the efficiency of synchronized online learning. For the forthcoming academic years, the majority of preclinical students favored online instruction [11]. Student perspective of Online Learning COVID-19 has swept the globe, wreaking havoc on the global health system. As a result of COVID-19, higher education has turned to offer courses online during pandemics. Students, on the other hand, have indicated anxiety over online learning and difficulty completing coursework. By knowing their concerns and preferences, universities and colleges may plan strategies to assist students in the case of the second wave of Coronavirus or any other catastrophe that demands an emergency transition to virtual learning. Several nations established infection preventive and control methods by restricting human contact to minimize COVID-19 transmission, according to WHO 2020. Patricia Aguilera-Hermida (2020), their research looked at college students' opinions of online learning uptake, use, and acceptability. According to the findings, students preferred face-to-face learning over online learning [14]. The findings indicate how attitude, motivation, self-efficacy, and technology use all play a role in 270 students' cognitive engagement and academic performance. Adnan et al (2020), In the face of the Coronavirus, the study looks at the perspectives of Pakistani university students on required digital and distance learning courses (COVID-19). According to the findings, online learning is impossible to fulfill desired objectives in poor nations such as Pakistan, where the vast majority of students are unable to utilize the internet due to operational and economic constraints. Other issues highlighted by higher education students were a lack of face-to-face interaction with teachers, reaction speed, and the loss of traditional classroom socialization. Also, the COVID-19 epidemic has compelled Indonesia's Ministry of Education and Culture to create regulations that would shift traditional classrooms to online classrooms. Agung et al (2020), Students' Perceptions of Online Learning During the COVID-19 Pandemic: A Case Study of English STKIP Students Pamane Talino, Pamane Talino, Pamane Talino, Student participation, accessibility, delivery of content and assignments, and use of e-learning platforms were all noted [17]. In STKIP Pamane Talino's English Language Education Study Program, the study identified three major barriers to conducting online learning: the first is the availability and sustainability of an internet connection, the second is the accessibility of teaching media, and the third is the compatibility of tools to access the media. According to the findings of this study, accessibility is still the most important element determining the success of online learning. Online education for STKIP Pamane Talino's English Language Education Study Program, and maybe Indonesia in particular, requires more user-friendly platforms to enhance student engagement. This is especially true for families that live in remote regions with limited access to the internet and other resources. Rasmitadila et al. (2020) conducted a study to investigate primary school teachers' perspectives on online learning as part of a program called School from Home that was developed in Indonesia during the COVID-19 Pandemic [15]. Thematic analysis of qualitative data was employed in the data analysis. The findings of the study revealed four key themes: teaching techniques, obstacles, support, and teacher motivation. Khalil et al (2020), to study undergraduate medical students' perceptions of the efficacy of synchronized online learning, a researcher from Qassim University's Unaizah College of Medicine and Medical Sciences used thematic analysis. The topic analysis uncovered four key themes: educational impact, time management, barriers encountered, and future desires. The online mode was well-received, with all participants agreeing that online sessions saved them time and that their performance improved as a result of the increased use of time [11]. However, they stated that they had several difficulties during sessions and online tests, including methodological, content perception, technological, and behavioral issues. Henaku et al, the study focuses on Ghanaian college students' online experiences and perspectives. Ten university students were chosen from four different universities. In the theme analysis, the following subjects were discovered[6]. Online learning nature, Connectivity difficulty, Web bundle, Device challenges, household production, and the results indicated that for teaching and learning, Ghana's colleges of education have used both social media and online learning platforms. Students have also encountered issues with internet connectivity, financial challenges due to the high cost of internet packages, device issues, and the need to assist with household production.

B. Latent Dirichlet Allocation

Topic modeling is an unsupervised machine-learning technique that uses clustering to extract latent variables from large quantities of text data. The idea of Latent Dirichlet Allocation was first proposed by David Blei, Andrew Ng, and Michael Jordan in a research paper published in 2003. It's one of the most used methods for subject modeling. Each document has a separate collection of terminology, and each topic has its vocabulary. The objective of LDA is to figure out what subject a document belongs to based on the words it contains [7].

Hidayatullah et al (2019) used LDA to apply topic modeling to Indonesian Twitter posts provided by the official BMKG Twitter account in Java. In topic modeling research, LDA has been highlighted as a promising method. Researchers chose five themes as a parameter for the LDA technique. According to their findings, General weather information and forecasts, as well as the most recent weather information in the Yogyakarta Region, weather forecast and warning in Central Java and West Java, earthquake information, and the most recent articles and calendar cropping information, are among the most frequently discussed topics [1]. In December 2019, a few coronavirus illness cases were first detected in Wuhan, Hubei, China. Liu et al (2020) study focused on the collection of COVID-19-related media articles and investigate patterns of the media-directed health message, as well as the media's role in China's ongoing COVID-19 problem [12]. With a sufficient topic number, the

researcher used latent Dirichlet allocation topic modeling to create keywords and subject names. According to the findings, the top three most popular themes were prevention and control techniques, medical treatment and research, and global or local social and economic issues. They conclude that topic modeling of news stories can give useful information on the role of mass media in early health communication. Using latent Dirichlet allocation, Sutherland et al (2020), identified and validated topics in the dataset, and use an inductive technique to the frame which subjects of interest Korean accommodation consumers deem significant by analyzing huge unstructured text data from 104,161 online evaluations. By expanding the scope of current significance dimensions by separating factors of service quality and location more accurately[19].

III. Methodology

The research will adopt an exploratory sequential approach. The gathered qualitative types' sentiments will then be translated into vectors, which are quantitative variables. Thematic analysis was performed on the data using Latent Dirichlet Allocation (LDA).

A. Instrument, Respondents and Sampling Technique

A survey questionnaire was given to the respondents using Google Forms. Each respondent was given a set of open-ended questions. The dataset that was used in the study was made up of the replies collected.

Respondents of the study were the students of the academic year 2021-2022 from the College of Computer Studies of the Camarines Sur Polytechnic Colleges. Due to the limitations brought by the pandemic, snowball sampling was used, in which each respondent is encouraged to share the questionnaire among their peers or classmates. Table III-A presents the Respondents by year level.

TABLE I
Respondents of the Study

Year Level	
1st year	133
2nd year	90
3rd year	96
4th year	52

Students by year level reveal that first-year students made up the majority of respondents (133), followed by third-year students (96), second-year students (90), and fourth-year students (52), as shown in Table III-A.

B. Procedure

1) Data Collection. The primary source of data was students' responses to the given questionnaires. Six open-ended questions are included in the data collection, along with the students' responses. The data collected was exported as a CSV file from Google Forms. Following that, the data was loaded into a Jupyter notebook.
2) Data Pre-processing. Once the data was loaded, data was being cleaned and pre-processed such as removing punctuations and stopwords, tokenization, and lemmatization. The researchers created the bigram and trigram models afterward.
3) Bag-of-Words (BoW). After the data was cleaned and pre-processed, the cleaned data were converted into a numerical representation. This includes preparing the dictionary and the corpus needed.
4) LDA Topic Modeling. When the data is clean and ready to train, it was fed into the LDA algorithm that distributes the number of topics and the number of words per topic.
5) Model Evaluation. The evaluation of an implemented algorithm's effectiveness in terms of perplexity and coherence score.
6) Results. This study analyzes the model's result to have a better understanding and interpret the individual and relationship of the topics.

IV. Results and Discussion

Fig. 1. Word cloud showing keywords of all five (5) topics

The results of the model outcome are presented and interpreted using Word cloud to visualize the model's data results. Word clouds are graphical representations of word frequency that give terms that appear more frequently in a given text more emphasis [3]. The larger the term in the image, the more frequently it appeared in the document/s. It can also be utilized at the reporting stage to communicate the most important points or topics. Shown in Figure 1 are the five (5) clusters of topics that are generated by the model.

- *Topic 0:* The topic described by these keywords is primarily concerned with online learning, highlighting its environment, the nature of classes, the time factor, and the challenges faced. The terms "face" and "way" might suggest comparisons with traditional learning methods or different approaches within the online learning sphere. The focus seems to be on the experience and process of learning in an online setting.
- *Topic 1:* The topic described by this cluster of keywords seems to focus on the challenges, disadvantages, and

mental health impacts associated with online learning. It emphasizes issues like the stress of assignment submissions, the abrupt transition to online formats, and the psychological strains such as depression. The keywords reflect a concern with how these factors affect students' ability to study effectively and the overall learning experience.

- *Topic 2:* This cluster of keywords suggests a focus on the technical and practical challenges of online learning, particularly around internet connectivity and its impact on the learning process. The emphasis on terms like "internet," "connection," "hard," and "difficult" suggests that students may struggle with accessing online classes due to poor internet connections, which can hinder their ability to learn effectively. The keywords also touch upon the broader aspects of online learning, such as time management and the ultimate goal of acquiring knowledge.
- *Topic 3:* This cluster of keywords suggests a focus on the overall structure and support systems within education, highlighting both traditional classroom settings and online learning components. The presence of terms like "system," "support," "classroom," and "self" indicates an interest in how different educational environments and methodologies interact. The keywords also suggest attention to group dynamics, specific educational practices, and various levels of education. Additionally, "watching" likely refers to the consumption of visual learning materials, which is particularly relevant in the context of online learning.
- *Topic 4:* This cluster of keywords suggests a focus on the dynamics of engagement and performance within the educational environment, with an emphasis on virtual or online schooling. Keywords like "focused," "fun," "perform," and "properly" indicate that both enjoyment and effectiveness are important considerations in the educational process. The mention of "virtual" highlights the relevance of online education, while "schooling" and "available" suggest a broader consideration of educational resources and opportunities.

V. Conclusion and Recommendation

The Latent Dirichlet Allocation (LDA) topic model has been effectively employed to categorize textual content and identify themes related to students' perceptions and attitudes towards online classes at CSPC during the pandemic. This study focused on students enrolled in Polytechnic Colleges in Camarines Sur, with data collected via questionnaires distributed through Google Forms. Using a qualitative research design, the efficacy of the LDA algorithm was observed, with coherence score and perplexity serving as reliable metrics for testing the model. The results were visualized using Word clouds, which emphasized the most frequently occurring terms and effectively communicated the key topics.

The analysis revealed five distinct clusters of topics. The first cluster, focusing on the online learning environment, highlighted the experience and process of learning in an online setting, including the environment, class nature, time management, and comparisons with traditional learning methods. The second cluster addressed psychological challenges, focusing on the mental health impacts and challenges of online learning, such as stress from assignments, abrupt transitions, and depression, which affect students' ability to study effectively. The third cluster emphasized technical and practical difficulties associated with online learning, particularly around internet connectivity and its impact on the learning process. The fourth cluster examined the structure and support systems within education, covering both traditional and online settings, and highlighted the importance of support mechanisms and different educational methodologies. The fifth and final cluster centered on the dynamics of engagement and performance in education, particularly in virtual or online environments, stressing the importance of focus, enjoyment, effective performance, and the availability of educational resources.

In conclusion, the LDA model has successfully identified and categorized key themes related to online learning during the pandemic, providing valuable insights into the challenges and experiences of students. The visual representation of these themes through Word clouds has proven to be an effective tool in highlighting the significant keywords and topics. This study underscores the importance of addressing psychological, technical, and structural challenges in online education to enhance the overall learning experience.

Future researchers might consider increasing the model's dataset to distribute topics more evenly and achieve better results. They could also use different evaluation methods to assess the model and compare the outcomes. Improving the model by filtering, stemming, altering the n-grams, or adjusting the LDA hyperparameters to uncover more coherent extraction topics is another avenue for enhancement. Additionally, employing another topic modeling toolkit with a different sampling-based implementation technique for LDA might yield different insights. Furthermore, creating a web tool that utilizes the LDA model would allow users to easily input the desired number of latent topics, adjust other parameters, and obtain a graphical representation of the extracted subjects based on the number of topics entered.

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