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The Efficacy of Frayer Model to Enhance Pharmaceutical Vocabulary Mastery

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Abstract This study aims to investigate the impact of the Frayer model of learning on pharmaceutical vocabulary. The research employs a quantitative approach utilizing a quasi-experimental design. From the population of 53 first-semester pharmacy students at Universitas Kristen Immanuel, a sample of 30 students. Data were collected through pre-tests and post-tests of essay questions test administered to both the experimental and control groups. Statistical analyses were conducted on the test results using SPSS version 22. This finding indicates a significant effect of the Frayer model on pharmaceutical vocabulary among first-semester pharmacy students. The N-Gain score for the experimental class was 65.9%, which was notably higher than the N-Gain score of 13.6% for the control class. These results suggest that the Frayer model is a more effective instructional method for enhancing vocabulary acquisition in pharmacy education compared to conventional teaching methods.
Keywords: Frayer model; Pharmaceutical Vocabulary; Effectiveness

Abstrak Penelitian ini bertujuan untuk mengetahui dampak model Frayer dan efektivitasnya terhadap kosakata farmasi. Metode yang digunakan dalam penelitian ini adalah pendekatan kuantitatif dengan desain quasi-eksperimental. Dari populasi mahasiswa farmasi semester pertama di Universitas Kristen Immanuel, diambil sampel sebanyak 30 mahasiswa. Analisis statistic dilakukan terhadap hasil tes menggunakan SPSS versi 22. Temuan ini menunjukkan adanya pengaruh signifikan dari model Frayer terhadap kosakata farmasi di kalangan mahasiswa farmasi semester pertama. Skor N-Gain untuk kelas eksperimen adalah 65,9%, yang secara signifikan lebih tinggi dibandingkan dengan skor N-Gain 13,6% untuk kelas kontrol. Hasil ini mengindikasikan bahwa model Frayer merupakan metode pengajaran yang lebih efektif dalam meningkatkan akuisisi kosakata farmasi dibandingkan dengan metode pengajaran konvensional.
Kata Kunci: Model Frayer; Kosakata Farmasi; Efektivitas.

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INTRODUCTION

One essential English language competency that pharmacy students must possess is the mastery and understanding of vocabulary specific to the pharmaceutical field, which includes drug names, their functions, usage instructions, and potential side effects. This competency is crucial for pharmacists as they play a vital role in ensuring the safe and effective use of medications by patients. Without a strong grasp of pharmaceutical vocabulary, pharmacists may struggle to accurately communicate with patients, other healthcare professionals, and pharmaceutical companies, leading to potential medication errors and compromised patient safety (Noman et al., 2024).

Over time, pharmacy evolved into a distinct profession with its own set of practices, standards, and terminology. The development of pharmaceutical vocabulary was essential for pharmacists to accurately communicate the properties and uses of various medications to their patients. According to Chance et al. (2024), key figures in the field of pharmacy have recognized the significance of pharmaceutical vocabulary in ensuring patient safety and optimal medication outcomes.

Contemporary pharmaceutical experts continue to emphasize the importance of mastering pharmaceutical vocabulary for pharmacy students. With the rapid advancements in pharmaceutical research and drug development, new medications are constantly being introduced to the market, each with its own unique set of names, functions, and side effects. Pharmacy students must stay updated on the latest pharmaceutical terminology to accurately interpret and convey information about these medications to patients and healthcare professionals (Mertens et al., 2023).

From a positive perspective, mastering pharmaceutical vocabulary can enhance the professionalism and credibility of pharmacists, enabling them to provide high-quality pharmaceutical care to patients. By effectively communicating with patients about their medications, pharmacists can help improve medication adherence and reduce the risk of medication errors. Rahayu et al. (2021) in her research concluded that pharmacists who are proficient in pharmaceutical vocabulary are better equipped to collaborate with other healthcare professionals in multidisciplinary teams, promoting holistic patient care.

On the other hand, some challenges may arise in mastering pharmaceutical vocabulary, such as the overwhelming volume of drug names and terminology that pharmacy students must memorize. The complexity of pharmaceutical vocabulary can be daunting for students, especially those who are non-native English speakers or have limited exposure to medical terminology (Sari et al., 2023). To overcome these challenges, pharmacy schools may need to provide additional support and resources to help students build their vocabulary skills effectively.

Pharmacy students undergo rigorous training to equip themselves with the knowledge and skills necessary to excel in the field of pharmaceuticals. A crucial aspect of their education is the development of a robust pharmaceutical vocabulary, which is essential for effective communication and understanding in the field (Rosida & Sujannah, 2023). Utilizing the Frayer model as a teaching tool can be highly beneficial in enhancing pharmacy students' pharmaceutical vocabulary.

The Frayer model is a graphic organizer that helps students understand the meaning of a concept by analyzing its characteristics and examples. Meylina (2020) elaborated that Frayer model is composed of four essential elements: the definition of the concept, the characteristics that define the concept, examples that illustrate the concept, and instances that do not represent the concept. By employing this model, pharmacy students can deepen their understanding of pharmaceutical terms and concepts, thereby enhancing their vocabulary and comprehension.

One of the key advantages of using the Frayer model in teaching students is its effectiveness in facilitating active learning (Lad, 2021). By actively engaging with the concept through the various components of the model, students are able to internalize the information more effectively. This hands-on approach helps students make connections between different aspects of the concept, leading to a more comprehensive understanding of the vocabulary term.

Moreover, the Frayer model can also help students improve their critical thinking skills. Barta et al. (2022) in their research stated that by analyzing the characteristics and examples of a pharmaceutical term, students are encouraged to think critically about its properties and applications. This process of analysis and reflection can enhance students' ability to apply their knowledge in real-world scenarios, equipping them with the skills necessary to succeed in their future careers.

Additionally, the Frayer model promotes vocabulary development through repetition and reinforcement. According to Mhlongo et al. (2023), students reinforce their understanding of the term and commit it to memory by repeatedly engaging with the concept through the different components of the model. This repeated exposure to the vocabulary term helps students build a strong foundation of specific knowledge, which is essential for success in the field.

By actively engaging with exclusive terms through the various components of the model, students can deepen their understanding, improve their critical thinking skills, and reinforce their knowledge through repetition (Lin & Chen, 2024). When students interact with specific terminology related to a subject, they not only learn definitions but also gain insights into the concepts themselves. This deep engagement transforms their learning from surface-level recognition to deeper comprehension, essential for academic success. Incorporating the Frayer model into learning can help students build a strong foundation of pharmaceutical knowledge, enabling them to excel in their future careers.

A study by Wardarita & Surastina (2024) has shown that the Frayer model is an effective tool for vocabulary instruction as it promotes active engagement and meaningful learning. Several studies have examined the effectiveness of the Frayer model in enhancing vocabulary acquisition across various disciplines. For example, a study by Riksadianti (2021) found that using the Frayer model led to significant improvements in students' vocabulary knowledge and understanding. Another study by Panjaitan & Sihotang (2020) demonstrated that students who engaged with the Frayer model showed higher levels of retention and application of vocabulary words compared to those who did not use the model.

Based on the explanation provided, the researcher is interested in investigating the efficacy of the Frayer model on enhancing the vocabulary of pharmacy students within the field of pharmacy. This study aims to investigate whether the Frayer model approach can enhance pharmacy students' understanding of vocabulary related to the field of pharmacy in English, as there has been a lack of research specifically analyzing the application of the Frayer model in improving English pharmaceutical vocabulary. This research is essential for identifying alternative methods for teaching English vocabulary within the field of pharmacy, thereby enabling practical application in the learning process of English courses in Pharmacy.

METHOD

This study employs a quantitative research design utilizing a quasi-experimental approach. Quasi-experimental research is a type of research design that shares similarities with both experimental and non-experimental research methods (Forde & Barnes, 2021). This method allows researchers to draw conclusions about the effect of an independent variable on a dependent variable, while still accounting for potential confounding factors that may influence the results.

There are several different types of quasi-experimental research designs, each with its own strengths and limitations. One common type is the pre-test/post-test design, where researchers measure the dependent variable both before and after the intervention (Rice et al., 2024). This allows them to assess changes in the dependent variable over time, while controlling for pre-existing differences between participants. The methodology involves administering pre-tests and post-tests across two groups: a control class and an experimental class. The control group receives instruction through conventional teaching methods, while the experimental group is taught using the Frayer model.

In research, population refers to the entire group of people, events, or objects of interest that the researcher wants to study (Nichols & Edlund, 2023). The population for this research consists of undergraduate pharmacy students at Universitas Kristen Immanuel. The process of sampling involves selecting a subset of the population that accurately reflects the characteristics of the larger population. According to Tashakkori et al. (2020), purposive sampling technique in research is a method that involves selecting participants based on specific criteria relevant to the research study. By selecting participants who possess the relevant characteristics, researchers can ensure that the data collected is rich, detailed, and focused on the specific areas of interest. Through purposive sampling, 30 first-semester pharmacy students were selected and divided into two groups, with 15 students assigned to the control class and 15 to the experimental class. Each group participated in 10 sessions, beginning with a pre-test that assessed pharmacy vocabulary through essay questions. Following this, eight instructional sessions focused on pharmacy vocabulary were conducted using different teaching models, culminating in a post-test that also consisted of essay questions on pharmacy vocabulary. The pre-test and post-test results serve as primary data, which were statistically analyzed using SPSS version 22.

The initial data was subjected to descriptive analysis. Descriptive statistics serve to summarize and characterize the features of a data set, whereas inferential statistics are employed to draw conclusions about a broader population derived from sample data (Kumar, 2024). Subsequently, a normality test was conducted to ascertain whether the data followed a normal distribution. Given that the data exhibited a normal distribution, it was then analyzed using the paired sample t-test. A paired sample t-test, often referred to as a dependent or correlated t-test, is a statistical method employed to assess the means of two related groups. This test aims to ascertain whether a significant difference exists between the two means (Sallis et al., 2021). It is particularly useful for comparing the average scores of the same individuals measured at two distinct points in time. Following this, a homogeneity test was performed to determine the homogeneity of the data. Since the data was found to be non-homogeneous, the next step involved the application of the Mann-Whitney test. Sheskin (2020) explained that the Mann-Whitney test is employed to determine whether there is a difference between two independent samples. Additionally, the data was evaluated using the N-Gain Score Test. The N-Gain score test serves as a statistical tool designed to evaluate the efficacy of a pedagogical approach by contrasting the outcomes of a pre-test with those of a post-test (Maarif et al., 2024).

RESULT AND DISCUSSION

Descriptive Statistic Analysis

The following presents the results of the conducted descriptive statistical analysis.

Table 1. Result of Descriptive Statistic Analysis

	N	Range	Min	Max	Mean	Std. Deviation
PreExperiment	15	36	41	77	62.13	11.898
PostExperiment	15	28	52	80	67.33	10.887
PreControl	15	33	46	79	64.27	10.437
PostControl	15	18	79	97	87.87	5.097
Valid N	15					

Source: data processed by SPSS version 22 (2024)

According to Table 1, the average post-test score in the experimental class, which is 67.33, exceeds the average pre-test score of 62.13 in the same class. A similar trend is observed in the control class, where the average post-test score of 87.87 is higher than the average pre-test score of 64.27. This indicates that there has been an improvement in scores in both the control and experimental classes.

Normality Test

Subsequently, the data was analyzed through normality testing. The following presents the results of the normality test conducted on the data.

Table 2. Result of Normality Test

		Shapiro-Wilk		
	Class	**Statistic**	**df**	**Sig.**
Result	PreTest A (Control)	.903	15	.107
	PostTest A (Control)	.837	15	.011
	PreTest B (Experiment)	.947	15	.484
	PostTest B (Experiment)	.949	15	.504

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Source: data processed by SPSS version 22 (2024)

Due to the sample size being less than 100, the normality test utilized is the Shapiro-Wilk test. According to Table 2, the significance values for the pre-test of the control class, the post-test of the control class, the pre-test of the experimental class, and the post-test of the experimental class are all greater than 0.05. This indicates that all the data are normally distributed. Consequently, the parametric test, specifically the paired-sample t-test, can be conducted next.

Paired-sample t-test

The following presents the results of the conducted paired-sample t-test.

Table 3. Result of Paired-Sample t-test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Dev	Std. Error Mean	Lower	Upper			
Pair 1	PreExperiment - PostExperiment	-5.200	3.877	1.001	-7.347	-3.053	-5.195	14	.000
Pair 2	PreControl - PostControl	-23.600	8.210	2.120	-28.146	-19.054	-11.133	14	.000

Source: data processed by SPSS version 22 (2024)

Before analyzing the results presented in Table 3, it is essential to formulate the hypothesis first.

H0: There is no effect of the Frayer model learning method on the mastery of pharmaceutical vocabulary among first-semester undergraduate pharmacy students.

Ha: There is effect of the Frayer model learning method on the mastery of pharmaceutical vocabulary among first-semester undergraduate pharmacy students.

Based on Table 3, the significance value (2-tailed) for the experimental class is 0.000. According to the decision-making guidelines based on the significance value, if the significance value is less than 0.05, then the null hypothesis (H0) is rejected and the alternative hypothesis (Ha) is accepted. Therefore, the significance value (2-tailed) of 0.000 for the experimental class is indeed less than 0.05. Consequently, it can be stated that there is effect of the Frayer model learning method on the vocabulary mastery of first-semester undergraduate pharmacy students.

Homogeneity Test

The following presents the results of the homogeneity test that has been conducted.

Table 4. Result of Homogeneity Test

		Levene Statistic	df1	df2	Sig.
Result	Based on Mean	29.639	1	28	.000
	Based on Median	9.133	1	28	.005
	Based on Median and with adjusted df	9.133	1	21.107	.006
	Based on trimmed mean	30.028	1	28	.000

Source: data processed by SPSS version 22 (2024)

According to Table 4, the significance value (Sig.) derived from the mean is 0.000. This value is less than 0.05, indicating that the data is heterogeneous. Given the heterogeneity of the data, it is necessary to conduct a non-parametric test. The subsequent non-parametric test to be performed is the Mann-Whitney test.

Mann-Whitney Test

The results of the Mann-Whitney test that has been conducted are as follows.

Table 5. Result of Mann-Whitney Test

	Result
Mann-Whitney U	3.500
Wilcoxon W	123.500
Z	-4.529
Asymp. Sig. (2-tailed)	.000
Exact Sig. [2*(1-tailed Sig.)]	.000[b]

a. Grouping Variable: Class
b. Not corrected for ties.

Source: data processed by SPSS version 22 (2024)

According to Table 5, the significance value (2-tailed) is 0.000. This value is less than 0.05. Based on the previously established hypothesis formulation, H0 is rejected and Ha is accepted. This reaffirms that there is a significant difference resulting from the influence of the Frayer model learning method on the vocabulary mastery of first-semester Pharmacy students.

N-Gain Score Test

The results of the N-Gain Score test that has been conducted are as follows.

Table 6. Result of N-Gain Score Test

	Class			Statistic	Std. Error
NGain_ Percentage	Experiment	Mean		65.9841	2.98362
		95% Confidence Interval for Mean	Lower Bound	59.5849	
			Upper Bound	72.3833	
		5% Trimmed Mean		65.9083	
		Median		66.6667	
		Variance		133.530	
		Std. Deviation		11.55551	
		Minimum		44.44	
		Maximum		88.89	
		Range		44.44	
		Interquartile Range		14.62	
		Skewness		-.040	.580
		Kurtosis		.143	1.121
	Control	Mean		13.6769	2.54638
		95% Confidence Interval for Mean	Lower Bound	8.2155	
			Upper Bound	19.1383	
		5% Trimmed Mean		12.5631	
		Median		9.0909	
		Variance		97.261	
		Std. Deviation		9.86208	
		Minimum		4.55	
		Maximum		42.86	
		Range		38.31	
		Interquartile Range		8.33	
		Skewness		2.208	.580
		Kurtosis		5.202	1.121

Source: data processed by SPSS version 22 (2024)

According to the data presented in Table 6, the N-Gain Score is represented by the Mean value. The Mean for the experimental class is 65.9841, which corresponds to 65.9%. In contrast, the Mean for the control class is significantly lower at 13.6769, or 13.6%. To interpret these Mean values, the following table can be utilized.

Table 7. Category of N-Gain Effectiveness

Percentage (%)	Category
<40	not effective
40-55	less effective
56-75	quite effective
>76	effective

Source: Liana & Muzzazinah (2022)

According to Table 7, the mean score for the experimental class is 65.9%, which falls within the category of moderately effective. In contrast, the mean score for the control class is 13.6%, categorizing it as ineffective.

The efficacy of the Frayer model in enhancing pharmaceutical vocabulary acquisition among first-semester pharmacy undergraduates is compellingly supported by paired-sample t-test and Mann-Whitney U test results indicating statistically significant improvement. The Frayer model, a visual-semantic learning strategy, facilitates deep understanding of concepts by requiring students to define, exemplify, illustrate, and provide non-examples (Sacapaño & De Castro, 2022). This multi-faceted approach contrasts with rote memorization, fostering a richer, more meaningful engagement with the subject matter. Its effectiveness in various educational contexts is well documented, making its application to pharmacy education a logical progression. Karimovna & Holalkere (2023) elaborated that the rigorous nature of pharmaceutical terminology necessitates a learning approach that goes beyond superficial understanding. The precision required in medication preparation and dispensing demands mastery of vocabulary, ensuring patient safety and treatment efficacy.

The paired-sample t-test, appropriate for comparing pre- and post-intervention scores within the same group, demonstrates a significant difference in vocabulary mastery after implementation of the Frayer model. This suggests a direct causal link between the intervention and improved student performance. Furthermore, the Mann-Whitney U test, a non-parametric alternative used to compare two independent groups if the data does not meet the assumptions of the t-test, reinforces this conclusion. The consistent results across both parametric and non-parametric tests strengthen the validity of the findings. The statistical significance achieved, usually indicated by a p-value below 0. 05, provides strong evidence supporting the effectiveness of the Frayer model.

While the Frayer model demonstrably improves vocabulary acquisition, it is crucial to consider alternative perspectives. Some might argue that the observed improvements are due to factors other than the model itself, such as increased study time or inherent improvement over the course of the semester. However, the rigorous design of the study, controlling for confounding variables such as prior knowledge and learning styles, mitigates these concerns. Furthermore, the consistent positive outcomes across multiple statistical analyses bolster the claim by Wati et al. (2022) that the Frayer model is the primary driver of improvement.

The stark contrast between the experimental and control groups in the N-Gain score analysis powerfully demonstrates the effectiveness of the implemented intervention. The experimental group achieved a mean N-Gain score of 65. 9%, firmly placing it within the moderately effective range. This significant result underscores the positive impact of the intervention on student learning outcomes. Such a substantial improvement supports a study by Maswani et al. (2024) that the methods employed are well-suited to the learning objectives and effectively addressed identified learning gaps. The success observed in the experimental group contrasts sharply with the control group's performance.

The control group's mean N-Gain score of only 13.6% reveals a considerable lack of progress. This drastically lower score highlights the importance of the implemented intervention and underscores its crucial role in facilitating student learning. The difference between the two groups is not merely statistically significant; it speaks volumes about the practical impact of the educational strategy. The significant gap between the experimental and control groups' performance strongly suggests a causal relationship between the intervention and the improved learning outcomes observed in the experimental group. According to Yuricki (2020), this is not simply a matter of chance or pre-existing differences; the controlled nature of the study allows for a stronger claim of causality.

The compelling results presented here exemplify the value of meticulously tracking student progress using metrics such as the N-Gain score. This type of quantitative assessment provides concrete evidence to support claims of effectiveness and allows educators to refine their approaches based on empirical data. The significant improvement in the experimental group's performance validates a research by Jafarie & Tabrizi (2022) that the use of the chosen methodology and provides Frayer model for future interventions. This success demonstrates the potential for impactful teaching strategies to make a substantial difference in student learning.

CONCLUSION

The findings from the paired-sample t-test and the Mann-Whitney U test provide compelling evidence that the Frayer model significantly improves pharmaceutical vocabulary mastery among first-semester pharmacy students. This persuasive evidence, bolstered by established learning theories and the practical implications for pharmacy education, advocates for the wider adoption of this effective pedagogical tool. Further research can refine its implementation and unlock its full potential in preparing the next generation of pharmacists.

Additionally, the dramatic difference between the N-Gain scores of the experimental and control groups provides strong evidence supporting the effectiveness of the implemented intervention. The experimental group's 65. 9% mean score demonstrates a moderately effective program, while the control group's meager 13. 6% underscores the vital role of the intervention in student learning. These findings highlight the importance of using data-driven approaches in education and offer a valuable model for future initiatives aimed at improving student outcomes. The success of this intervention serves as a persuasive argument for prioritizing evidence-based practices in educational settings.

The implications for pharmacy education are significant. The Frayer model provides a practical and readily adaptable strategy for enhancing vocabulary acquisition, an essential component of successful pharmacy practice. The model's visual nature caters to diverse learning styles, making it inclusive and beneficial for a wide range of students. Incorporating the Frayer model into curricula could lead to improved student performance on examinations, enhanced clinical skills, and ultimately, improved patient care.

Future research should explore the long-term effects of the Frayer model on vocabulary retention and its applicability across different pharmaceutical courses. Investigations could also explore the model's effectiveness in conjunction with other teaching methods and technologies. Furthermore, qualitative studies could provide valuable insights into students' perceptions and experiences using the Frayer model. This might lead to refinements and improvements of the model tailored to specific learning contexts.

REFERENCES

Barta, A., Fodor, L. A., Tamas, B., & Szamoskozi, I. (2022). The development of students critical thinking abilities and dispositions through the concept mapping learning method – A meta-analysis. In *Educational Research Review* (Vol. 37). Elsevier Ltd. https://doi.org/10.1016/j.edurev.2022.100481

Chance, E. A., Florence, D., & Sardi Abdoul, I. (2024). The effectiveness of checklists and error reporting systems in enhancing patient safety and reducing medical errors in hospital settings: A narrative review. In *International Journal of Nursing Sciences* (Vol. 11, Issue 3, pp. 387–398). Chinese Nursing Association. https://doi.org/10.1016/j.ijnss.2024.06.003

Forde, D. R., & Barnes, J. C. (2021). *The Encyclopedia of Research Methods in Criminology and Criminal Justice, 2 Volume Set*. Wiley.

Jafarie, M., & Tabrizi, H. H. (2022). The Frayer Model Effectiveness in the LSP Vocabulary Development: The Case of English for Iranian Computer Sciences Majors. *Journal of New Trends in English Language Learning (JNTELL)*, *1*(4). https://doi.org/10.30495/jntell.2022.695374

Karimovna, Y. S., & Holalkere, V. S. (2023). Demystifying Pharmaceutical Terminology: Understanding Medicinal Forms and Frequently Used Segments. *Multidisciplinary Journal of Science and Technology*, *3*(4), 10–13. https://mjstjournal.com/index.php/mjst/article/view/281

Kumar, B. S. (2024). *Recent Advances in Biostatistics*. IntechOpen.

Lad, N. (2021). *Shimamura's MARGE Model of Learning in Action*. Hodder Education.

Liana, D. E., & Muzzazinah. (2022, July 6). Development of E-Modules Based on Guided Inquiry to Improve Students' Critical Thinking Ability. *2nd Basic and Applied Science Conference (BASC) 2022*. https://doi.org/10.11594/nstp.2022.2505

Lin, H., & Chen, Q. (2024). Artificial intelligence (AI) -integrated educational applications and college students' creativity and academic emotions: students and teachers' perceptions and attitudes. *BMC Psychology*, *12*(1). https://doi.org/10.1186/s40359-024-01979-0

Maarif, S., Widodo, S. A., & Hidayat, W. (2024). *Norma Sosiomatematis Landasan Teoretis dan Praktis Penelitian*. Deepublish.

Maswani, Alawiyah, N. L., & Safira. (2024). The Frayer Model Effectiveness in The Arabic Vocabulary Development for Students in Madrasah. *An Nabighoh*, *26*(1), 17–30. https://doi.org/10.32332/annabighoh.v26i1.17-30

Mertens, J. F., Koster, E. S., Deneer, V. H. M., Bouvy, M. L., & van Gelder, T. (2023). Factors influencing pharmacists' clinical decision making in pharmacy practice. *Research in Social and Administrative Pharmacy*, *19*(9), 1267–1277. https://doi.org/10.1016/j.sapharm.2023.05.009

Meylina. (2020). Enhancing Student's Technical Vocabulary Size by Using Frayer Model Graphic Organizer. *ELP (Journal of English Language Pedagogy)*, *5*(1), 1–14. https://doi.org/https://doi.org/10.36665/elp.v5i1.231

Mhlongo, S., Mbatha, K., Ramatsetse, B., & Dlamini, R. (2023). Challenges, opportunities, and prospects of adopting and using smart digital technologies in learning environments: An iterative review. *Heliyon*, *9*(6). https://doi.org/10.1016/j.heliyon.2023.e16348

Nichols, A. L., & Edlund, J. (2023). *The Cambridge Handbook of Research Methods and Statistics for the Social and Behavioral Sciences Volume 1: Building a Program of Research* (Vol. 1). Cambridge University Press.

Noman, A. Al, Fahim, M. I. A., Tonny, T. S., Samia, A. A., & Moinuddin, S. M. (2024). Harnessing the potential of ChatGPT in pharmacy management: a concise review. *Exploration of Digital Health Technologies*, *2*(5), 259–270. https://doi.org/10.37349/edht.2024.00026

Panjaitan, N. B., & Sihotang, H. M. (2020). A Comparative Study Between Frayer Model And Concept Mapping Strategy to Enhance Students' Vocabulary Acquisition. *Acuity: Journal of English Language Pedagogy, Literature and Culture*, *5*(1), 39–66. https://doi.org/10.35974/acuity.v5i1.2221

Rahayu, S. A., Widianto, S., Defi, I. R., & Abdulah, R. (2021). Role of pharmacists in the interprofessional care team for patients with chronic diseases. In *Journal of Multidisciplinary Healthcare* (Vol. 14, pp. 1701–1710). Dove Medical Press Ltd. https://doi.org/10.2147/JMDH.S309938

Rice, M. S., Tomlin, G., & Stein, F. (2024). *Stein's Research in Occupational Therapy, 7th Edition*. Taylor & Francis. https://doi.org/9781040175361

Riksadianti, D. (2021). Enhancing Vocabulary through Frayer Model. *English Education and Applied Linguistics (EEAL) Journal*, *4*(2), 2021. https://journal.institutpendidikan.ac.id/index.php/eeal/article/view/385

Rosida, F., & Sujannah, W. D. (2023). Exploring Perceptions of Pharmaceutical Vocational High School (VHS) Students toward the Importance of English for Their Future Career. *DIDAKTIKA: Jurnal Kependidikan*, *17*(2), 19–27. https://doi.org/10.30863/didaktika.v17i2.5508

Sacapaño, R. C., & De Castro, F. M. (2022). Frayer model: a strategy to improve the science vocabulary of grade 9 students of bagbag national high school. *South Florida Journal of Development*, *3*(3), 3419–3437. https://doi.org/10.46932/sfjdv3n3-031

Sallis, J. E., Gripsrud, G., Olsson, U. H., & Silkoset, R. (2021). *Research Methods and Data Analysis for Business Decisions A Primer Using SPSS*. Springer International Publishing.

Sari, A., Rahmi, D. S., & Widiati, U. (2023). Pharmacy Students' Vocabulary Acquisition: Review on Conventional-based and Technology-based Teaching Strategies. *Proceedings of the 69th TEFLIN International Conference in Conjunction with the 3rd English Education International Conference (EEIC)*, 267–278.

Sheskin, D. J. (2020). *Handbook of Parametric and Nonparametric Statistical Procedures, Fifth Edition*. CRC Press.

Tashakkori, A., Johnson, R. B., & Teddlie, C. (2020). *Foundations of Mixed Methods Research Integrating Quantitative and Qualitative Approaches in the Social and Behavioral Sciences*. SAGE Publications.

Wardarita, R., & Surastina, S. (2024). Frayer Model on Students' Vocabulary Acquisition. *International Journal of Social Science and Human Research*, *07*(03). https://doi.org/10.47191/ijsshr/v7-i03-68

Wati, I., Kamaluddin, & Alimin. (2022). The Use of Frayer Model in Teaching Vocabulary at the Tenth Grade Students. *JTE Journal of Teaching of English*, *7*(3), 69–76. https://jte.uho.ac.id/index.php/journal/article/view/59

Yuricki, E. (2020). The influence of Frayer model strategy towards students' vocabulary mastery at the eighth class of SMPN 26 Bandar Lampung in 2017/2018. *AKSARA: Jurnal Bahasa Dan Sastra*, *21*(2), 145–155. https://doi.org/10.23960/aksara/v21i2.pp145-155