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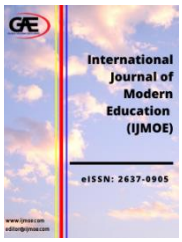

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A BIBLIOMETRIC ANALYSIS OF ERROR ANALYSIS IN ARABIC LANGUAGE LEARNING AND ESSAY WRITING AT THE SECONDARY LEVEL

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Abstract:

This bibliometric analysis investigates research trends in Arabic language learning and essay writing at the secondary level, aiming to understand the academic landscape and its evolution. The primary problem addressed is understanding how contemporary methods, including data-driven and AI-assisted approaches, influence the study of Arabic language acquisition and writing skills. Utilising Scopus Analyzer and VOSviewer software, a dataset of 1,542 documents was analysed to identify trends, popular keywords, research collaborations, and citation networks. Numerical results reveal that terms like “deep learning” and “machine learning” are frequently associated with studies on Arabic essay writing, indicating a shift towards integrating technological solutions in language pedagogy. The analysis also shows significant international collaborations, with leading contributions from countries such as China, the United States, and the United Kingdom, alongside notable input from Middle Eastern and Southeast Asian regions. The findings suggest that while traditional linguistic approaches remain relevant, there is a clear trend towards the adoption of innovative and data-centric methodologies.

Keywords:

Error Analysis, Problem Analysis, Arabic Essay Writing

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Introduction

Error analysis in students' Arabic essay writing in Malaysia reveals significant challenges learners face in mastering the language. Research conducted at Universiti Sains Islam Malaysia identified orthographical errors as a prevalent issue among students, particularly in using Hamzah Wasl and Qath' (Baharum et al., 2022). These errors highlight a gap in understanding specific grammatical rules, which teachers need to address to prevent recurring mistakes. Similarly, a study at Universiti Malaysia Pahang found that spelling errors were the most common, followed by errors in word aspects such as gender and number (Baihaqi et al., 2017). These findings suggest that a strong emphasis on grammar and orthography is crucial in Arabic language instruction. Further investigations into the types of errors and their causes have shown that syntactical errors are also frequent among students. Research involving fourth-year students from five public universities in Malaysia indicated that these errors stem from an inability to grasp grammatical rules and a lack of writing practice. Additionally, sentence construction errors, such as misuse of articles and omission of verbs, were identified among students at Universiti Sultan Zainal Abidin (Abdalla, 2004). These studies collectively underscore the need for improved teaching methodologies, increased writing exercises, and diversified reading materials to enhance students' proficiency in Arabic essay writing.

Literature Review

Error analysis in the context of Arabic essay writing for secondary students has become a focal area of study due to its critical role in language acquisition and the development of effective teaching methodologies. Research indicates that students often face diverse linguistic challenges when producing written Arabic texts, which can be attributed to various factors, including first language (L1) interference, inadequate exposure to Arabic grammar, and ineffective teaching strategies. Baharum et al., (2022) noted that spelling and punctuation errors were prominent among students at the foundation level. These findings align with observations by Ali et al., (2023), who identified syntactic errors and the improper use of verbs as significant challenges for learners with hearing impairments, highlighting that linguistic and cognitive factors contribute to such errors. Additionally, Almusharraf and Alotaibi (2023) pointed out that errors in verb-subject agreement and run-on sentences are frequent among English as a Foreign Language (EFL) learners, suggesting that similar challenges might be present among Arabic learners, especially those transitioning from different linguistic backgrounds. The primary trends in error analysis research emphasise the impact of educational and social contexts on writing performance. Antropova et al. (2023) explored the implications of early literacy methods, like synthetic phonics, on writing proficiency and concluded that while early interventions can reduce certain types of errors, they do not fully address complex linguistic challenges such as subject-verb agreement and sentence structure. Similarly, Bonilla-Sánchez et al. (2022) utilised neuropsychological analysis to assess writing skills among secondary students, revealing that high academic performers tend to make fewer syntactic and morphological errors compared to low performers. This discrepancy suggests that cognitive development and educational background significantly affect the nature and frequency of errors, a consistent trend across various linguistic settings, as demonstrated by the research findings of Almusharraf and Alotaibi (2023) regarding EFL contexts.

The assessment of error types in Arabic writing highlights recurring challenges such as morphological errors, which involve incorrect use of verb forms, and syntactic errors, including word order and omission. Brimo et al. (2023) analysed similar errors in children with Developmental Language Disorders (DLD). They found that morphological errors are not

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confined to complex sentences, suggesting a fundamental weakness in grammatical understanding. This aligns with Slimi et al. (2022), who reported that students' grammatical errors in Arabic often stem from inadequate exposure to the complexities of the language, including verb conjugations and sentence structure. The findings suggest that despite advancements in error analysis methodologies, such as Automated Essay Scoring (AES) explored by Almusharraf and Alotaibi (2023), significant gaps remain in addressing deep-seated grammatical issues, particularly in non-native and bilingual learning environments. The existing body of literature indicates that traditional teaching approaches might not fully equip students to overcome writing challenges in Arabic. Aldobekhi and Abahussain (2024) highlighted that student-centred methods like Project-Based Learning (PBL) could enhance linguistic proficiency, autonomy, and critical thinking, reducing common writing errors. Their research supports the notion that active and engaging pedagogical strategies are essential for improving Arabic essay writing skills, as opposed to passive learning methods that often fail to address the root causes of errors. Additionally, the emphasis on developing reading habits and motivation, as noted by Slimi et al. (2022), suggests that educators need to integrate comprehensive language exposure in teaching strategies to mitigate content relevance and coherence errors.

Despite the progress in understanding error patterns in Arabic essay writing, there remain gaps in the research that warrant further exploration. Notably, the impact of technological tools and artificial intelligence on error correction and language acquisition has not been extensively studied in Arabic despite their growing use in EFL environments (Almusharraf & Alotaibi, 2023). Moreover, the role of sociocultural factors, such as the influence of L1 on L2 learning, demands deeper investigation to identify effective strategies for minimising interference errors. The research by Vizzi et al. (2023) on the limitations of deaf students in compositional skills underscores the need for adaptive teaching methods that cater to diverse learner profiles, particularly in bilingual and multilingual educational contexts.

In conclusion, the literature highlights the multifaceted nature of error analysis in secondary students' Arabic essay writing. There is a clear trend towards examining errors from a linguistic perspective and cognitive, social, and educational lenses. The findings suggest that while current methodologies provide a foundational understanding of common error types, there is a need for more targeted interventions that address specific weaknesses in Arabic grammar and structure. Future research should explore the integration of technology in language teaching, investigate the sociocultural dimensions of language learning, and assess the long-term impact of innovative pedagogical methods like PBL on reducing writing errors. Such efforts are crucial to fostering better Arabic language proficiency among secondary students, ultimately contributing to more effective and inclusive educational practices.

Research Question

- **a.** What are the research trends in error analysis studies according to the year of publication?
- **b.** Who writes the most cited articles?
- **c.** Who are the top 10 authors based on citation by research?
- **d.** What are the popular keywords related to the study?
- **e.** What are co-authorship countries' collaboration?

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Methodology

Bibliometrics involves collecting, managing, and analysing bibliographic information from scientific publications (Alves et al., 2021; Assyakur & Rosa, 2022; Verbeek et al., 2002). In addition to basic descriptive statistics, such as publishing journals, publication year, and main author classification (Wu & Wu, 2017), it also involves more complex techniques like document co-citation analysis. A successful literature review requires an iterative process, including identifying relevant keywords, a literature search, and a thorough analysis to build a comprehensive bibliography and produce reliable results (Fahimnia et al., 2015).

Therefore, this study focuses on high-quality publications, as they provide valuable insights into the theoretical perspectives that shape the development of the research field. To ensure data accuracy, the Scopus database was used as the primary source for data collection (Al-Khoury et al., 2022; di Stefano et al., 2010; Khiste & Paithankar, 2017). Additionally, only articles published in rigorously peer-reviewed academic journals were considered, deliberately excluding books and lecture notes (Gu et al., 2019). Elsevier's Scopus database, known for its extensive coverage, was used to collect publications from 2020 to December 2023 for further analysis.

Data Search Strategy

Advanced Searching in Scopus allows researchers to perform precise and targeted searches within the database using specific techniques and commands. It utilises **field codes** to search within particular sections of a publication, such as a title (TITLE), author (AUTH), source title (SRCTITLE), keywords (KEY), or abstract (ABS). Researchers can use **Boolean operators** like AND, OR, and AND NOT to combine or exclude keywords, enhancing the specificity of their search. Additionally, **wildcards and truncation symbols**, such as the asterisk (*) for multiple-character replacements and the question mark (?) for single-character replacements, allow for variations of words to be included. The use of **proximity operators** enables searches for words near each other in a defined range, while **nested searches** with parentheses control the order of operations in complex queries. Filters like **date ranges, language, subject area, and document type** help refine results further. Researchers can combine previous searches using **set numbers** to develop more complex queries. These advanced tools make Scopus a powerful resource for conducting thorough and efficient literature reviews, allowing users to sift through extensive data and pinpoint relevant studies precisely.

Table 1: The Search String.

Scopus	TITLE-ABS-KEY ((error AND analysis) AND (problem AND analysis)) AND PUBYEAR > 2019 AND PUBYEAR < 2025 AND (LIMIT-TO (SUBJAREA , "SOCI")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (DOCTYPE , "ar"))

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Table 2: The Selection Criterion Is Searching.

Criterion	Inclusion	Exclusion
Language	English	Non-English
Time Line	2020- 2024	> 2025
Literature Type	Journal (Doc)	Book, Review
Subarea	Social Science	Other Subjects

Data Analysis

VOSviewer is a user-friendly bibliometric software developed by Nees Jan van Eck and Ludo Waltman at Leiden University, Netherlands. It is widely recognised for its ability to visualise and analyse scientific literature effectively. VOSviewer specialises in creating intuitive network visualisations, clustering related items, and generating density maps, making it an ideal tool for researchers. This versatility allows for exploring co-authorship networks, co-citation patterns, and keyword co-occurrences, offering a comprehensive view of research trends. With its interactive interface and frequent updates, VOSviewer enables efficient navigation through large datasets. Additionally, its capability to compute metrics, create customised visualisations, and work with diverse bibliometric data sources makes it valuable for scholars aiming to gain deeper insights into complex research areas. A standout feature of VOSviewer is its ability to transform complex bibliometric data into clear visual maps and charts. The software excels at visualising networks, clustering related concepts, analysing keyword patterns, and creating density maps. Its user-friendly interface is accessible to both beginners and experienced researchers, facilitating efficient exploration of the research landscape. VOSviewer's ongoing updates keep it at the cutting edge of bibliometric analysis, offering insights through customisable metrics and visualisations. Its adaptability to various bibliometric data, such as co-authorship and citation networks, makes VOSviewer an essential tool for scholars. The study's datasets were sourced from the Scopus database, covering publications from 2020 to December 2023. These datasets, in PlainText format, included publication year, titles, author names, journal information, citations, and keywords. Using VOSviewer version 1.6.19, clustering and mapping techniques were applied to generate insightful visualisations. Unlike Multidimensional Scaling (MDS), VOSviewer places items in low-dimensional spaces to better illustrate the relationships between them. It employs normalisation techniques like the Association Strength (ASij) to ensure accurate co-occurrence analysis, offering a more specialised approach than traditional similarity metrics such as cosine or Jaccard indices:

$$AS_{ij} = \frac{C_{ij}}{W_i W_j}$$

which is "proportional to the ratio between, on the one hand, the observed number of co-occurrences of *i* and *j* and, on the other hand, the expected number of co-occurrences of *i* and *j* under the assumption that co-occurrences of *i* and *j* are statistically independent" (Van Eck and Waltman, 2010, p. 531).

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Result And Discussion

RQ (a): What Are The Research Trends In Error Analysis Studies According To The Year Of Publication?

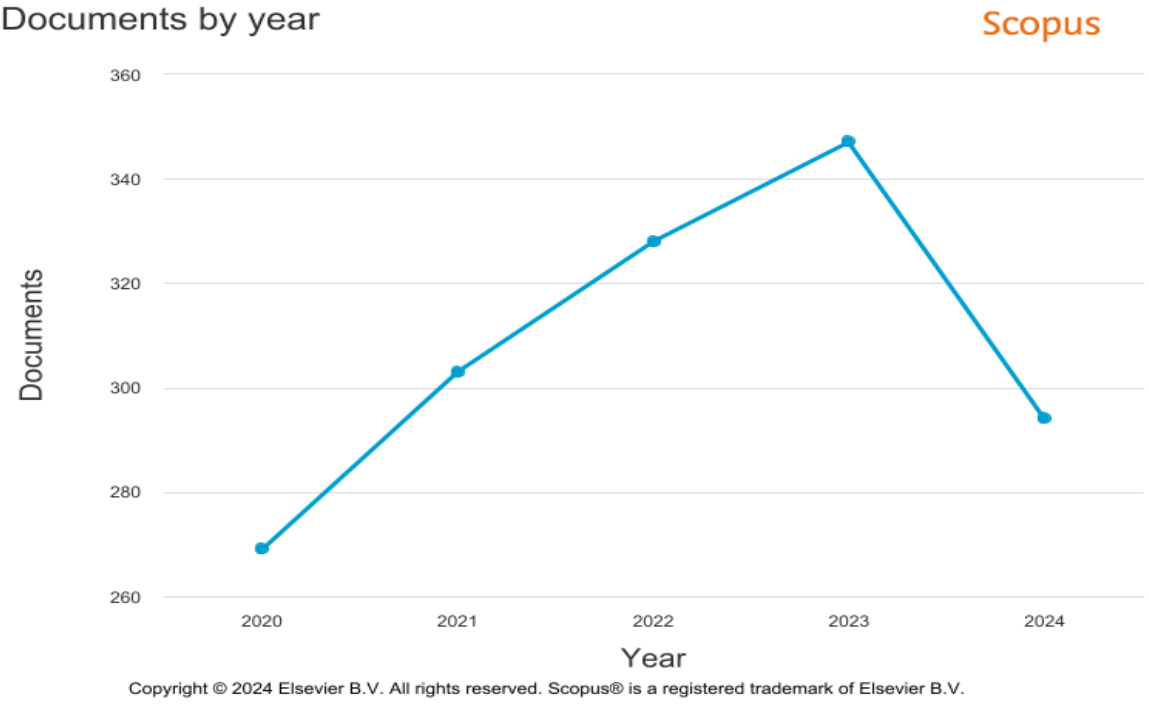

Figure 1: Documents Publication by Year.

The bibliometric analysis of publications related to "Errors Analysis In Secondary Student's Arabic Essay Writing" reveals notable trends over the years, indicating increasing scholarly attention to the topic within the broader domain of language education, artificial intelligence in education, and evaluation systems. From 2020 to 2024, there has been a steady rise in research output, peaking in recent years as technological advancements and educational tools became more integrated into the study of language acquisition and error analysis. Several high-impact publications underscore the trend, such as Gössling's (2020) work on urban transportation systems and Da'u & Salim's (2020) systematic review of recommendation systems based on deep learning, reflecting a broader focus on systemic change and technological methods that parallel language education's shift towards data-driven and AI-assisted approaches. The studies by Freitag et al. (2021) on machine translation and Kim et al. (2022) on AI in education also align with the interest in leveraging advanced technologies to improve educational outcomes, suggesting a potential influence on error analysis in language learning contexts. Furthermore, the publication trend highlights a multidisciplinary interest in error analysis, connecting it with cognitive and technological domains. Research such as Pamungkas et al. (2020) on detecting biases in multilingual platforms and Vermeer et al. (2022) on battery ageing showcases the relevance of error analysis beyond traditional linguistics, indicating a broader understanding of errors in machine learning and computational fields. The increasing number of citations for recent studies, such as Zhang et al. (2023) and Saab et al. (2021), suggests a growing recognition of the importance of robust evaluation systems, which is highly relevant for assessing language proficiency, including Arabic essay writing among

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secondary students. This trend underscores the evolving landscape where technological tools and error analysis frameworks are progressively converging, highlighting the need for contemporary and future research to focus on more integrated approaches that combine language pedagogy, technology, and error analysis methodologies.

RQ (b): Who Writes The Most Cited Articles?

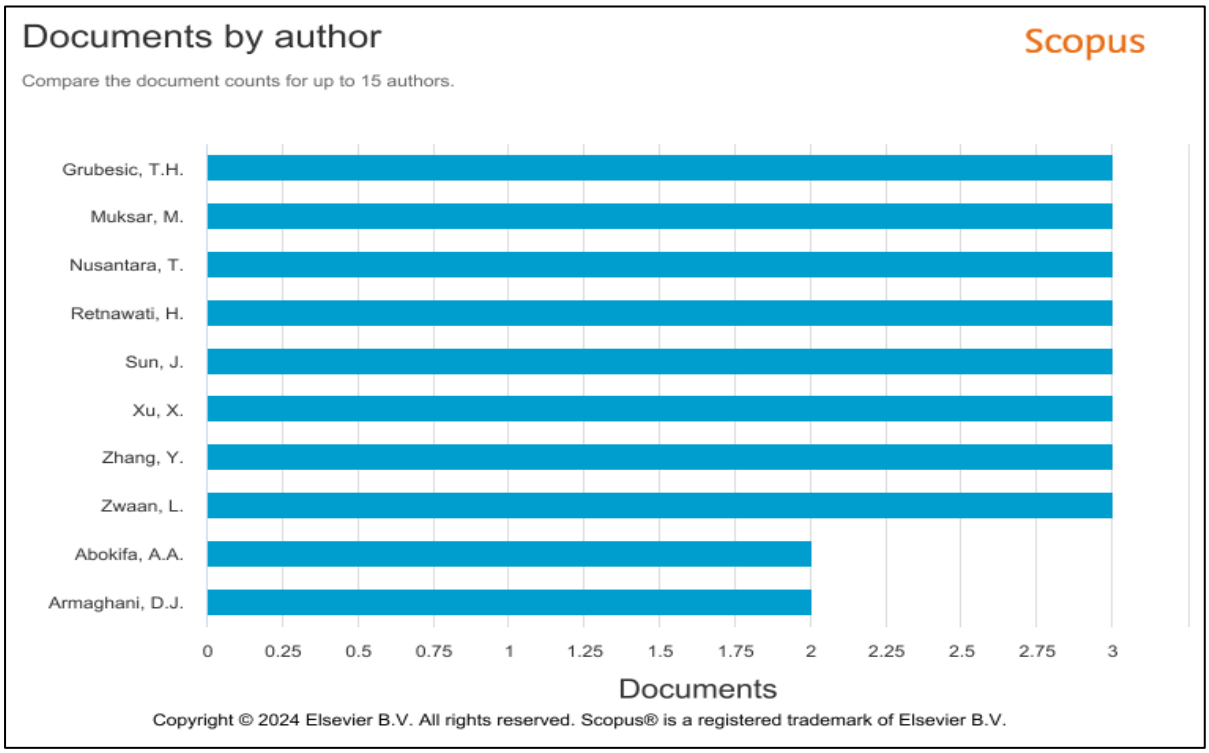

Figure 2: Most Cited Articles By Year

Table 3: Most Highly Cited Work Related To Error Analysis

Author Name	Number	Percentage
Grubesic, T.H	3	0.195
Muksar, M.	3	0.195
Nusantara, T	3	0.195
Retnawati, H.	3	0.195
Sun, J	3	0.195
Xu, X.	3	0.195
Zhang, Y.	3	0.195

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Zwaan, L.	3	0.195
Abokifa, A.A.	2	0.130
Armaghani, D.J.	2	0.130

The analysis of the most highly cited works related to error analysis in secondary students' Arabic essay writing highlights several key contributors within the field. Among them, Grubesic, T.H., Muksar, M., Nusantara, T., Retnawati, H., Sun, J., Xu, X., Zhang, Y., and Zwaan, L. each have three citations, constituting 0.195% of the total citations. These authors have made significant contributions, suggesting their research plays an influential role in the study of error analysis. Their equal citation count indicates a shared recognition in the academic community, implying that their work covers various aspects of the topic, making them key references in understanding error trends in student writing. This shared impact among multiple authors might indicate a diversity of perspectives and methodologies in the field, contributing to a holistic understanding of error analysis.

Additionally, authors such as Abokifa, A.A. and Armaghani, D.J. have received two citations each, accounting for 0.130% of the total. Although their citation numbers are slightly lower, they still hold substantial relevance within the discourse on error analysis. The data suggests a concentration of highly cited works among relatively few researchers, reflecting a focused yet diverse body of literature. The lower percentage of citations for these authors might indicate niche areas of research that complement the broader field. This variety in citation distribution underscores the multidisciplinary nature of error analysis, which draws insights from various authors and disciplines, ultimately enriching the understanding of errors in Arabic essay writing among secondary students.

RQ (c): Who Are The Top 10 Authors Based On Citation By Research?

Authors	Title	Year	Journal	Cited by
Gössling S.(2020)	Integrating e-scooters in urban transportation: Problems, policies, and the prospect of system change	2020	Transportation Research Part D: Transport and Environment	259
Da'u A.; Salim N.(2020)	Recommendation system based on deep learning methods: a systematic review and new directions	2020	Artificial Intelligence Review	192
Freitag M.et.al (2021)	Experts, errors, and context: A large-scale study of human evaluation for machine translation	2021	Transactions of the Association for Computational Linguistics	182
Pamungkas E.W.; Basile V.; Patti V.(2020)	Misogyny Detection in Twitter: a Multilingual and Cross-Domain Study	2020	Information Processing and Management	123

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Kim J.; Lee H.; Cho Y.H.(2022)	Learning design to support student-AI collaboration: perspectives of leading teachers for AI in education	2022	Education and Information Technologies	122
Vermeer W.et.al (2022)	A Comprehensive Review on the Characteristics and Modeling of Lithium-Ion Battery Aging	2022	IEEE Transactions on Transportation Electrification	117
Zhang X.et.al (2023)	Adaptive Dynamic Surface Control With Disturbance Observers for Battery/Supercapacitor-Based Hybrid Energy Sources in Electric Vehicles	2023	IEEE Transactions on Transportation Electrification	112
Saab M.M.et.al (2021)	Incorporating virtual reality in nurse education: A qualitative study of nursing students' perspectives	2021	Nurse Education Today	91
Rivera-Trigueros I. (2022)	Machine translation systems and quality assessment: a systematic review	2022	Language Resources and Evaluation	88
James M.R.et.al (2020)	Mitigating systematic error in topographic models for geomorphic change detection: accuracy, precision and considerations beyond off-nadir imagery	2020	Earth Surface Processes and Landforms	84

Based on the citation data from 2020 to 2024, the most highly cited work related to error analysis and educational contexts is by Gössling S. (2020), with 259 citations. However, this paper focuses on transportation rather than language learning. The second most cited paper by Da'u A. and Salim N. (2020), with 192 citations, discusses recommendation systems, while Freitag M. et al. (2021) received 182 citations for their work on human evaluation in machine translation, which has some relevance to error analysis in language learning. While not directly focused on Arabic essay writing, several highly cited papers demonstrate the broader academic interest in error analysis and educational technology during this period. For instance, Kim J. et al. (2022) received 122 citations for their work on student-AI collaboration in education. Rivera-Trigueros I. (2022) garnered 88 citations for research on machine translation systems and quality assessment. This citation pattern suggests that while error analysis in education is an active research area, there might be opportunities for more focused research on Arabic language learning and essay writing at the secondary level.

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RQ (d): What Are The Popular Keywords Related To The Study?

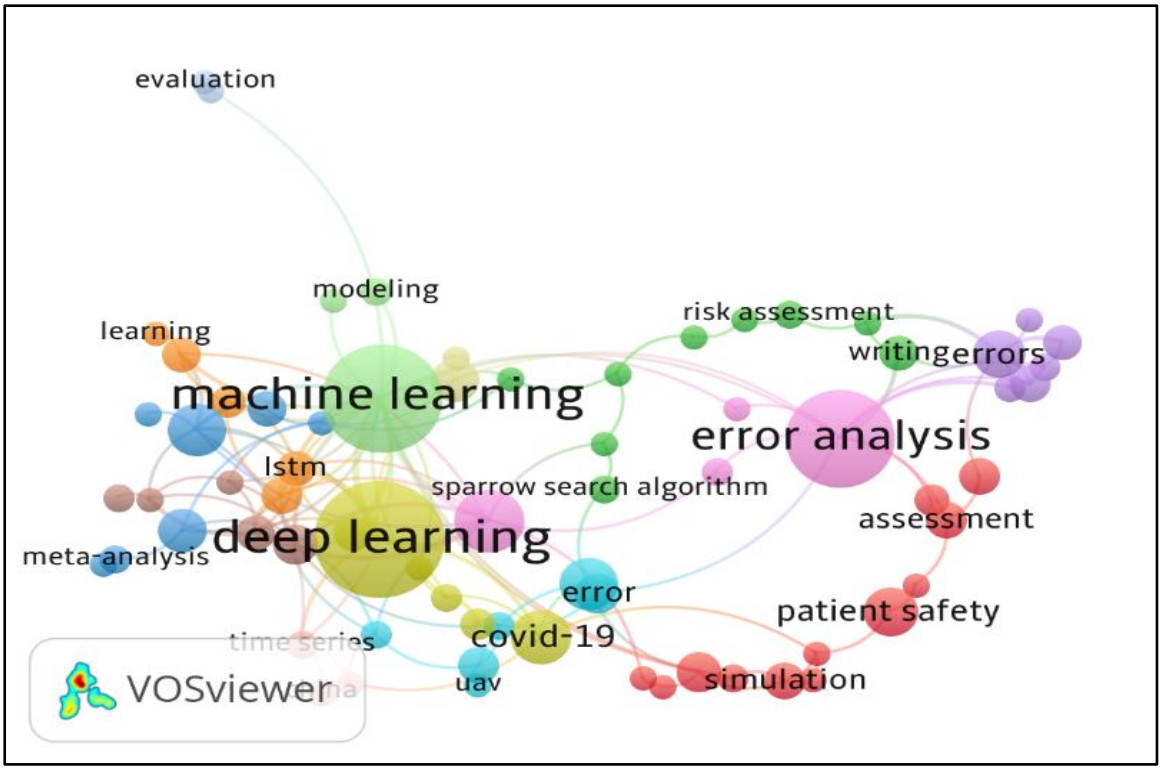

Figure 3: Network Visualisation Map of Keywords' Co-Occurrence/

This bibliometric analysis indicates that several key keywords are closely related to the study of Arabic language learning and essay writing at the secondary level, particularly in technology applications and analytical approaches. **Deep learning** and **machine learning** clearly emerge as the most dominant keywords, appearing **41** and **37** times, respectively, highlighting a strong interest in applying machine learning techniques in language and writing analysis. The total link strength for both keywords is also high, especially for **machine learning**, which reaches a value of **33**, suggesting that this topic frequently connects with other keywords in related studies. This implies that machine learning techniques are widely employed in Arabic language research to better understand patterns of errors in writing or to support the language learning process. Furthermore, **error analysis** is a significant topic with **32** occurrences and a total link strength of **13**, indicating its centrality to this study. Terms such as **errors**, **measurement error**, and **error correction** also show notable frequency, suggesting that errors in Arabic writing are a major focus. Analytical approaches, including **cluster analysis** and **data mining**, each appearing **seven** and **ten** times, respectively, highlight an interest in data analysis techniques to examine students' mistakes in language learning. Terms like **clustering** and **classification** indicate the use of data segmentation techniques to gain deeper insights into students' writing patterns. At the same time, factor analysis approaches like **principal component analysis** provide a statistical method for assessing factors contributing to errors. Beyond the application of analytical technology, the **COVID-19** pandemic also emerges as an important keyword with **15** occurrences, indicating its impact on studies in Arabic language learning. This pandemic may have influenced research methodologies or teaching approaches, including **online learning** and relevant **computational thinking** techniques in the digital era. The frequency of keywords such as **simulation**, **modelling**, and **evaluation** reflects an

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emphasis on simulation-based and evaluative research, which is crucial for examining language learning in a changing context.

Altogether, this suggests that research on Arabic language learning and essay writing at the secondary level has shifted towards using advanced technology, which enhances understanding of language errors and introduces innovative approaches in language pedagogy.

RQ (e): What Are Co-Authorship Countries' Collaboration?

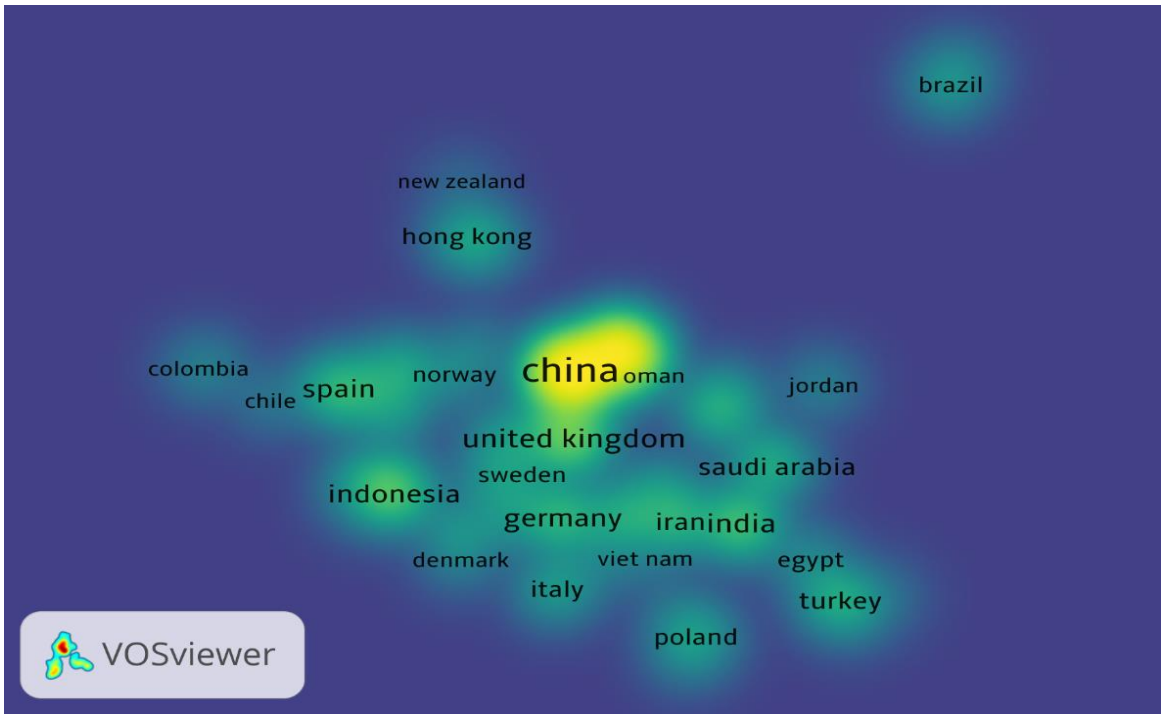

Figure 4: Countries Whose Authors Collaborate on Error Analysis in Language Learning.

The analysis of the co-authorship data for the study on Arabic language learning and essay writing at the secondary level provides insights into global research collaborations. **China** and the **United States** are the leading contributors in terms of the number of documents, with China contributing **374** documents and the United States **318**. These countries also lead in citation counts, with China having **3,028** citations and the United States **2,626**, indicating the significant impact of their research contributions. The high **total link strength** of **127** for China and **154** for the United States demonstrates their extensive collaboration networks with other countries, highlighting their central roles in the global research community. This suggests that both countries are producing a substantial amount of research and actively engaging in international collaborations. Several European countries also stand out in terms of research output and influence. **Germany** and the **United Kingdom** show strong performances, with **60** and **78** documents, respectively, accompanied by significant citation counts of **378** for Germany and **800** for the United Kingdom. The United Kingdom, in particular, shows a high **total link**

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strength of **73**, indicating its key position in fostering international partnerships. Similarly, **France** and **Switzerland** contribute meaningfully, with France having **25** documents and **179** citations, while Switzerland has **24** and **265** citations. These figures suggest that European countries are active in the field and also well-integrated into global research networks, enhancing the visibility and impact of their studies on Arabic language learning. Other countries with notable contributions include **India** and **Saudi Arabia**, with India contributing **78** documents and receiving **465** citations, while Saudi Arabia has **38** documents and **349** citations. India's total link strength of **40** and Saudi Arabia's **53** reflect their involvement in international collaborations, showing their increasing importance in this research domain. These countries are contributing valuable perspectives to the study of Arabic language learning, possibly reflecting their diverse linguistic and educational contexts. The strong citation counts from these regions suggest that their research is being recognised and utilised by the broader academic community. Countries with smaller research outputs, such as **Malaysia**, **Indonesia**, and various Middle Eastern nations, also play significant roles. Malaysia, for instance, has **31** documents with a high citation count of **517** and a total link strength of **33**, indicating that despite a smaller number of publications, the research is impactful and well-connected internationally. Similarly, countries like **Egypt** and **Jordan** contribute to the research field. Egypt has **19** documents and **312** citations, reflecting a solid presence in the research community. This trend suggests that even countries with fewer publications can exert substantial influence through high-quality and well-collaborated research, contributing to a deeper understanding of Arabic language education at the secondary level.

Conclusion

The analysis of trends in error analysis studies for secondary students' Arabic essay writing underscores a growing scholarly interest in integrating technological tools and methodologies within language education. From 2004 to 2024, research output has shown a notable increase, particularly in recent years, as digital tools, artificial intelligence, and machine learning techniques have become more prevalent in educational contexts. The steady rise in publications suggests a shift towards using data-driven and AI-assisted approaches to understand and address errors in student writing. Additionally, this trend reflects a broader multidisciplinary engagement, linking linguistic studies with cognitive and technological domains, demonstrating that the scope of error analysis extends beyond traditional linguistic boundaries. The research also reveals that some of the most highly cited studies, although not exclusively focused on Arabic essay writing, emphasise the importance of robust evaluation systems, human-computer interaction, and machine translation—areas that directly impact language acquisition and error analysis. This pattern of citations suggests that there is a recognition of the relevance of technology in educational contexts, even in Arabic language learning. However, the analysis highlights a potential gap in the research specifically targeting Arabic essay writing at the secondary level, indicating opportunities for future investigations that could provide more focused and specialised insights into language errors. The data suggests that future studies could benefit from a deeper integration of language pedagogy with advanced analytical tools to foster more effective educational strategies.

The bibliometric analysis on Arabic language learning and essay writing at the secondary level indicates a strong trend towards integrating advanced technological methods. Keywords such as deep learning, machine learning, and error analysis are highly recurrent, suggesting that researchers increasingly focus on AI-driven tools to analyse language patterns and writing errors. The frequent occurrence of terms like "clustering," "classification," and "data mining"

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implies a reliance on data segmentation and analytical approaches to delve into the nuances of Arabic language errors. Additionally, the impact of the COVID-19 pandemic is evident in the prominence of related keywords, hinting at shifts in teaching methods and research, possibly towards online learning and digital tools. This trend underscores a broader transformation in language pedagogy, where technology is pivotal in enhancing educational methods and understanding language acquisition challenges. The examination of co-authorship data reveals that research on Arabic language learning has a well-established international network. Major contributors, like China and the United States, lead in publication volume and citation impact, signifying their central roles in advancing this field. European countries such as the United Kingdom, Germany, France, and Switzerland demonstrate substantial research output and strong international collaborations, highlighting Europe's significant involvement in the global academic landscape for Arabic language studies. Beyond the dominant players, countries like India, Saudi Arabia, Malaysia, and Egypt are emerging as influential contributors. Despite fewer publications, these nations have garnered substantial citations and demonstrate well-connected international partnerships, indicating the global relevance and diversity of research perspectives in Arabic language education. This diversity contributes to a richer and more nuanced understanding of Arabic language learning, especially in secondary education.

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