$A icQoL2024KotaKinabalu$

https://www.amerabra.org

12th AMER International Conference on Quality of Life
The Magellan Sutera Resort, Kota Kinabalu, Malaysia, 26-28 Jan 2024

Grammar and Technology:
A bibliometric exploration of research trends and influential works

Tengku Nazatul Shima Tengku Paris[1]*, Maimanah Samsuri[1], Hafiza Abas[2]
*Corresponding Author

[1] Faculty of Language Studies, Universiti Teknologi MARA Cawangan Pahang, Raub, Malaysia
[2] Advanced Informatics School, Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia

tnshima@uitm.edu.my, maimanah@uitm.edu.my, hafiza.kl@utm.my
Tel: +60199515668

Abstract

The study delves into the pivotal role of Grammar in scholarly communication, emphasising the need for a nuanced understanding of evolving grammatical research. Conducting a bibliometric analysis of 381 papers from the Scopus database (2015-2023), it explores grammar teaching and learning via technology. Employing advanced methods, the research identifies influential authors, institutions, and countries, tracks evolving themes, and assesses funding sources. The study utilises tools like Microsoft Excel, VOS Viewer, and Harzing to unveil partnerships, current research areas, and impact assessment. By categorising five clusters, it sheds light on underexplored research areas, offering insights for future investigations into grammar research.

Keywords: Grammar, Technology, Bibliometric.

1.0 Introduction

The convergence of Grammar and technology has become a central focus in the ever-evolving field of language studies, highlighting the significant influence of technological progress on linguistic research and teaching methods (Janaki Manokaran, 2023). With the growing digitalisation of our societies, the utilisation, study, and communication of language are experiencing significant revolutionary shifts. The paper does a thorough bibliometric analysis, examining the extensive collection of scientific articles that study the complex connection between Grammar and technology. The study does a meticulous bibliometric analysis, utilising 381 papers from the Scopus database covering 2015 to 2023. A previous study established the basis for our investigation, offering essential knowledge about the field of grammar and technology study in Academia (Tavakoli, M. 2021). The study's primary objective is to investigate the complex nature of grammar instruction and acquisition, specifically about technological progress. Using sophisticated bibliometric techniques, we aim to identify and analyse the discipline's most significant authors, universities, nations, and subjects, providing a comprehensive overview of the landscape of grammatical discourse. We conduct an extensive examination that goes beyond analysing individual contributions. We aim to uncover collaborative networks, identify current research directions, and evaluate the overall impact on the subject.

To enhance our study, we utilise well-established tools commonly used in academic research, such as Microsoft Excel, VOS Viewer, and Harzing. These tools are employed for citation, content, and network analysis. The bibliometric assessment is enhanced by

thoroughly examining the latest scientific literature, establishing a solid basis for our investigation (Verbeek et al., 2002). The study identifies essential individuals and patterns and examines the alliances between writers, universities, and countries, providing insight into the collaborative dynamics that influence the subject. Furthermore, the study identifies and categorises five clusters of research fields related to teaching and learning grammar via technology. The framework offers a thorough overview and guidance for exploring the changing landscape in the field.

The work aims to provide a comprehensive and perceptive analysis of the current scholarly conversation on grammar and technology research, thereby establishing the foundation for future studies on linguistic knowledge's fluid and evolving nature (Haleem A. et al., 2021). Our exclusive focus was directed on the subsequent study inquiries:

1. What are the research trends in Grammar and technology studies according to the year of publication?
2. Which authors are considered the most prominent in Grammar and technology?
3. How much has been published in the Grammar and technology area concerning the affiliated organisations?
4. What are the funding sponsors of Grammar and technology research?
5. What are the prevailing research themes and country density in Grammar and technology?

2.0 Literature Review

Within the dynamic realm of Academia, the convergence of Grammar and technology has become a significant area of focus, influencing the accuracy of language and the effectiveness of scholarly communication. The literature study aims to explore the intricate connection between Grammar, academic discourse, and language learning facilitated by technology. It aims to provide insights into how technological innovations have revolutionised language instruction and intellectual involvement.

Natural language processing (NLP) has significantly stimulated groundbreaking research in grammatical analysis. Chomsky's early publications in 1957 established the theoretical foundation for generative Grammar. However, it is the incorporation of computational techniques that has driven the field's progress. The groundbreaking work of Manning and Schütze (1999) in statistical NLP has significantly advanced our comprehension of grammatical structures by employing machine learning techniques.

With the widespread use of digital communication platforms, the study of Grammar now includes traditional written forms and the intricacies of online conversation. Crystal's groundbreaking study on internet linguistics (2002) investigates the influence of technology on language usage, emphasising the development of novel grammatical norms in digital communication. The emergence and development of emojis, acronyms, and other unconventional language components in online environments have garnered significant attention from scholars investigating the relationship between Grammar and digital communication (Danet & Herring, 2007).

The importance of Grammar in academic speech has long been recognised as crucial for linguistic precision (Bikowski, D. 2018). The significance of grammatical conventions in various disciplines highlights the need to thoroughly comprehend changing trends and influential research (Dibekulu, Dawit. 2022). Fundamental comprehension establishes the framework for investigating how language acquisition facilitated by technology can augment these crucial linguistic abilities.

Incorporating technology into language education has become more widespread, with various tools and platforms transforming the methods of teaching and acquiring grammatical skills. The study conducted by Bikowski, D. (2018) sheds light on the significant impact that technology may have on grammar instruction. It highlights how technology can enhance learning by facilitating interactive and captivating encounters.

The focal point is a bibliometric analysis conducted on a range of papers from the Scopus database, covering the period from 2015 to 2023. A total of 381 papers were included in the analysis. The thorough analysis of present patterns in grammar study utilises sophisticated bibliometric techniques to identify significant authors, universities, countries, funding and theme areas within the field. The analysis monitors the development of research trends and explores fundamental works that stimulate academic discussions.

An in-depth comprehension of the partnerships among authors, universities, and countries in Grammar and technology research is crucial, going beyond just quantitative evaluations. Examining ongoing research topics, academics' endeavours, and their consequent influence on the field (Haleem A. et al., 2021) enhance our comprehensive understanding of the collaborative dynamics and broader ramifications of technological interventions in language acquisition.

Essential tools for analysis include Microsoft Excel, VOS Viewer, and Harzing tools, which are crucial in aiding citation, content, and network analysis. Their frequent utilisation in academic study highlights their effectiveness in analysing the complex network of grammatical research and technology-driven language acquisition, establishing a basis for the ongoing investigation.

The Identification of Prominent Scholars and Research Areas in the field of Grammar, highlighting their major contributions to the academic discussion through numerous publications. The classification of seven discrete study clusters offers a systematic perspective for examining different aspects of technology-based grammar instruction and acquisition.

The study goes beyond just summarising existing work and paves the way for future studies in grammar and technology research that have yet to receive enough attention. The identified clusters present potential avenues for researchers aiming to contribute to the evolving field of linguistic knowledge, offering a guide for ongoing investigation and advancement in technology-driven Grammar acquisition.

3.0 Methodology

Bibliometrics is a discipline that combines, organises, and assesses bibliographic information from academic publications (Verbeek et

al., 2002). Aside from conventional descriptive statistics, such as examining publishing journals, publication year, and significant author categorisation (Wu & Wu, 2017), the study also incorporates sophisticated methodologies, such as document co-citation analysis. To conduct a comprehensive literature review, it is crucial to follow a systematic approach that involves identifying relevant keywords, doing a thorough literature search, and conducting a detailed analysis of the selected literature. Applying this approach is crucial in generating a trustworthy bibliography and obtaining accurate and reliable results (Fahimnia et al., 2015). This section encompasses the methodologies for selecting search words, evaluating the initial search outcome, and enhancing the search results. Meier (2011) states that scholarly publications referencing the Clarivate Analytics Journal Citation Reports (JCR) impact factor indicate a journal's exceptional quality. Therefore, the main aim of this study was to focus exclusively on publications with substantial impact since they can provide crucial insights into the theoretical framework for expanding the research field. As stated, the study's data was collected from (Scopus) database (Di Stefano et al., 2010). In addition, to ensure the incorporation of reputable sources, the study primarily focused on scholarly works that underwent rigorous scrutiny by field specialists and were later published in prestigious academic journals. The methodology intentionally omitted books and conference proceedings from the analysis.

Although Scopus provides a wide range of publications, it is essential to recognise that it has limitations in terms of complete coverage, especially when compared to Web of Science (WoS), which has significant coverage dating back to 1990. According to Aghaei Chadegani et al. (2013), Scopus mainly affects newer studies. Hence, while employing Scopus for this research, it is crucial to acknowledge the possibility of coverage gaps, especially regarding older material. The study analysed literature from the Social Science Citation Index (SSCI), the Science Citation Index Expanded, and the Arts and Humanities Citation Index. The analysis focused on citation and bibliographic records in the social sciences and humanities from 2015 to 2023. Most of these records are located in Clarivate Analytics' WoS Core Collection. Thus, the previously specified collection was utilised to obtain papers for the current inquiry, as Aghaei Chadegani et al. (2013) indicated.

The study utilised a screening technique to identify the appropriate search phrases for retrieving relevant papers. The inquiry commenced by searching the Scopus database using the designated search terms "Grammar and technology" in the title, abstract, and keywords. The search was improved by using the keywords TITLE-ABS-KEY (Grammar AND teaching AND learning AND technology). In addition, the search was limited to academic works in social science, computer science, and arts. The strategy resulted in the collection of a total of 381 articles. The query string was then modified to prioritise the search terms "Grammar teaching and learning" and "technology," specifically focusing on students' ability as learners. A total of 381 results were obtained using this method, which was then further examined to include only research publications written in English while excluding article reviews. After doing a thorough search utilising well-selected search terms, a total of 381 publications were acquired. Subsequently, these works underwent bibliometric analysis. The analysis included all papers on Grammar and technology retrieved from the Scopus database, covering 2015 to 2023.

4.0 Data Analysis

The data sets were obtained from the Scopus database and included information such as the year of publication, title of the paper, author's name, journal, citation, and keyword. The study evaluated data sets from 2015 to 2023 using VOSviewer software, specifically version 1.6.15. The software application was used to study and generate maps by implementing VOS clustering and mapping technologies. VOSViewer is a viable alternative to the Multidimensional Scaling (MDS) technique developed by Van Eck and Waltman (2010). The method's goal is similar to MDS's as both strive to arrange objects in a low-dimensional space to accurately reflect their relationships and similarities, as shown by the distances between them (Appio et al., 2014). Unlike multidimensional scaling (MDS), which mainly concentrates on computing similarity measures like Jaccard indices and cosine, the VOS method employs a more appropriate approach for standardising co-occurrence frequencies (Van Eck & Waltman, 2007). This strategy involves the utilisation of association strength (ASij), which is computed using the following formula:

$$AS_{ij} \frac{1}{4} \frac{C_{ij}}{W_i W_j}$$

Van Eck and Waltman (2010, p. 531) state that the measure in question is directly linked to the ratio between the observed number of co-occurrences of variables i and j and the predicted number of co-occurrences of i and j, assuming that the co-occurrences of i and j are statistically independent. Thus, by employing this index, VOSviewer applies a mapping technique that minimises the weighted sum of squared distances between all pairs of objects, resulting in a visual representation in a map. Appio et al. (2016) utilised the LinLog/modularity normalisation technique. Furthermore, the data set underwent visualisation procedures utilising VOSviewer, which unveiled patterns derived from mathematical relationships. Multiple analyses were performed, including keyword co-occurrence and co-authorship analysis.

The researcher's established inquiries will address the findings of the analysis. Based on the first research question, what are the research trends in Grammar and technology according to the year of publication? The subsequent study yielded the following findings:
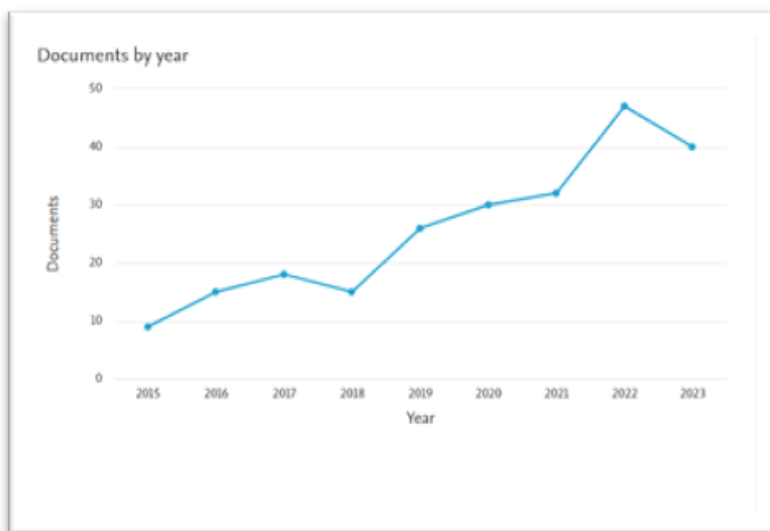
Figure 1: Document by year of publication
(Source: Scopus)

Figure 1 displays the chronological analysis of research about Grammar and technology, encompassing the years 2015 to 2023. The data indicates a consistent growth in research studies, except for a specific year. 2018, there was a decline in research, with only 15 publications compared to the 18 documents in 2017. Additionally, in 2023, there were 40 publications, seven fewer than in 2022. The highest number of articles were published in 2022, totalling 47 papers. This was followed by 2023, with 40 publications. The next highest number of publications occurred in 2021, with 32 documents. In 2015, the income from research or publication in this title reached its lowest point, with only nine papers. However, it subsequently experienced a steady increase in the following years. In 2016, there was a significant proliferation of publications, with 15 being released.

To address the second research question about identifying the most renowned authors in Grammar in Academia. The findings are as follows:
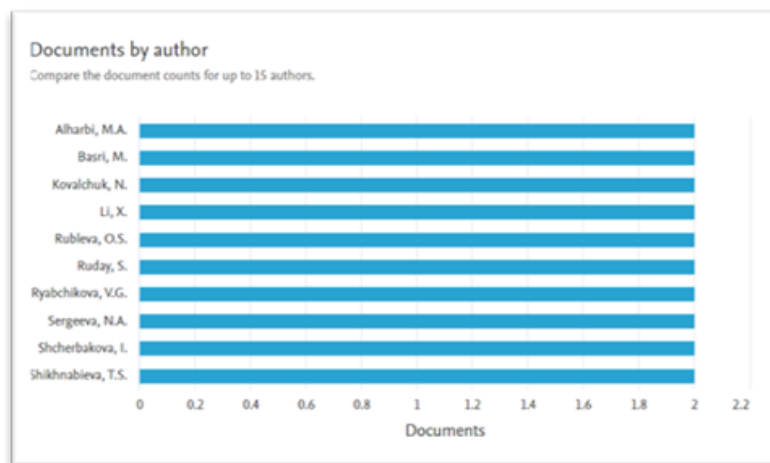

Figure 2: Document by number of authors
(Source: Scopus)

Figure 2 displays the top 10 authors who have authored works on Grammar and technology. Research has indicated that the highest-ranking ten authors have written an equal number of papers, namely two documents each, despite their diverse linguistic origins and racial backgrounds. The writers include Alharbi, M.A., Basri, M., Kovalchuk, N., Li, X., Rubleva, O.S., Ruday, S., Ryabchilkova, V.G., Sergeeva, N.A., Shcherbakova, I., and Shikhnabieva, T.S.

The following data address research question three, which pertains to how much has been published in the Grammar and technology area concerning the affiliated organisations.
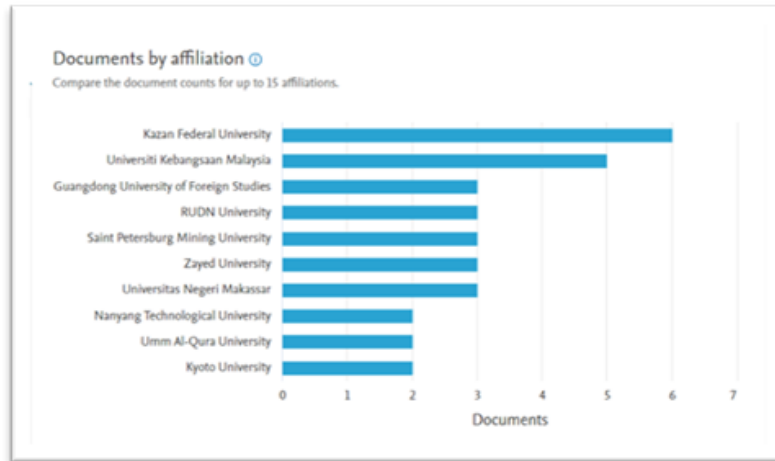
Figure 3: Document by number of affiliated organisations
(Source: Scopus)

Kazan Federal University has released six articles on Grammar, while Universiti Kebangsaan Malaysia has published five papers. Guandong University of Foreign Studies, RUDN University, Saint Petersburg Mining University, Zayed University, and Universitas Negeri Makasar contributed three publications. The remaining three universities, namely Nanyang Technological University, Umm Al-Qura University, and Kyoto University, have two publications.

The provided data contains the results to address the fourth research inquiry about the financing sponsors of Grammar and technology research.
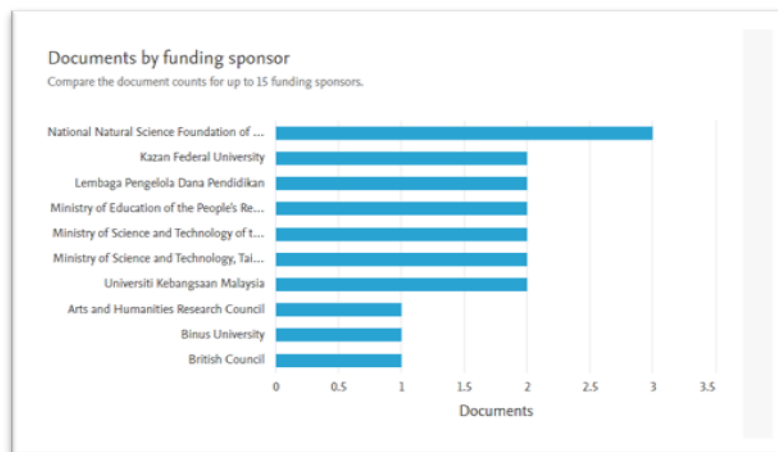

Figure 4 Document by number of funding sponsors
(Source: Scopus)

Regarding the primary financial supporters of Grammar and technology research initiatives, The National Natural Science Foundation has sponsored 30 research papers supporting Grammar and technology research efforts. Subsequently, the Russian Government Program of Competitive Growth of Kazan Federal University, Lembaga Pengelola Dana Pendidikan Indonesia, Ministry of Education and Science of the Russian Federation, Minobrnauka, Ministry of Science and Technology of the People's Republic of China, MOST; Ministry of Science and Technology of Taiwan, MOST and Universiti Kebangsaan Malaysia have each provided sponsorship for 20 publications. Furthermore, the Arts and Humanities Research Council, Binus University, and the British Council have generously sponsored the publication of 10 works.

The following findings address the fifth research inquiry: What are the prevailing research themes in technology-driven language learning?

Figure 5 shows the analysis of the co-occurrence of keywords based on network visualisation based on the topic Grammar and Technology in Academia. The Node size represents the frequency of occurrence of the keyword, and the larger node size means the most frequently used keywords. The result shows 78 items and five 5 cluster groups, with 1112 network links and a total link strength 2587. These five clusters are present in different colours. The first cluster with a red colour consisted of 18 items, with the top five occurring terms: teaching, students, education, foreign languages, and language learning. The second cluster in green colours consisted of 18 items, and the top five occurring terms are educational computing, teachers, humans, learning and teaching methods. The third cluster in blue colours consisted of 18 items. The list of the top five occurring terms in this cluster includes learning systems, education

41

computing, linguistics, natural language processing and technology. The fourth cluster with yellowish-green colours consisted of 14 terms, and the five highest items are engineering education, multimedia systems, English teaching, college English, and English education. The last cluster with purple colour consisted of 10 items, which are the most focused on e-learning, computer-aided instruction, teaching and learning, curricula, and virtual reality.
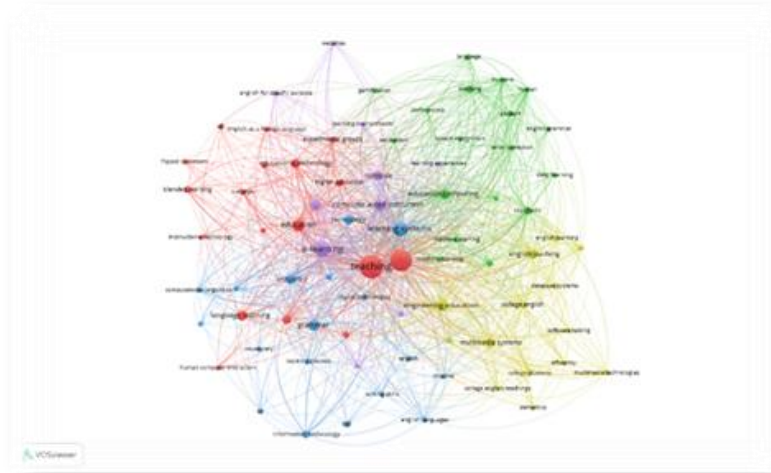

Figure 5: Keyword co-occurrence in network visualisation map
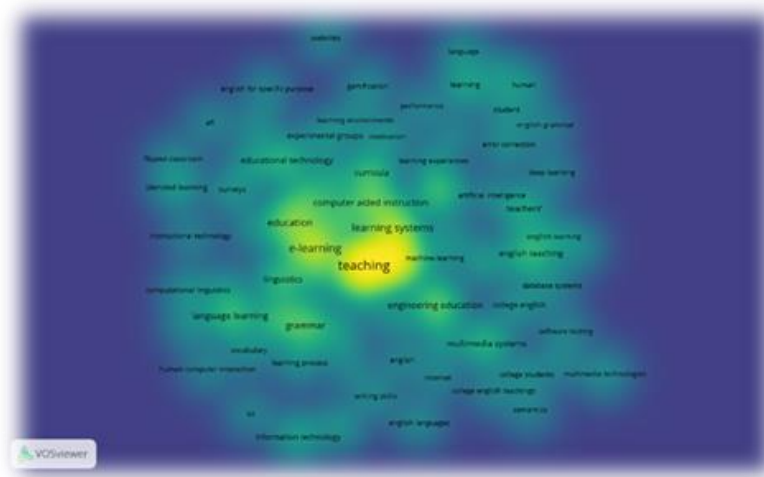*(source: VOSViewer)*

Figure 6: Keyword co-occurrence in density visualisation map
(source: VOSViewer)

Figure 6 refers to the density visualisation map of the co-occurrence of the items based on the topic Grammar and technology: A Bibliometric Exploration of Research Trends and Influential Works. It is the same as what has been discussed in network visualisation. Still, more emphasis on the monotonous words in the study consists of bright yellow areas representing the topic's hotpots. In contrast, green areas indicate less important or less debated items in this topic, in addition to showing the interrelationships of the terms with the other terms. From the results of this research, the most outstanding and brightest keywords are teaching (107); besides, the most frequently used words are e-learning (53), followed by learning systems (40) and computer-aided instruction (25).

Figure 7 shows the density visualisation map of the co-authorship in the Countries based on the same topic. Here, it can be seen that three areas have brightness or a bright yellow colour that symbolises the country's hotspot. In addition to the area that is covered by the green colour, the findings also show these areas are located somewhat apart from each other compared to the keywords co-occurrence, which is seen focusing on the one area point. Three of these areas are China, with 62 documents, followed by the United States, with 47 papers, and the Russian Federation, with 31 documents. On the green areas, the United Kingdom has the highest publication of 19 papers and the lowest is Sweden with five documents, while the other countries found in the Green Zone are Malaysia (14), Indonesia (12), Spain (11), Iran (10), Australia (9), Taiwan (8), Hong Kong (8), Japan (7), and France (6).
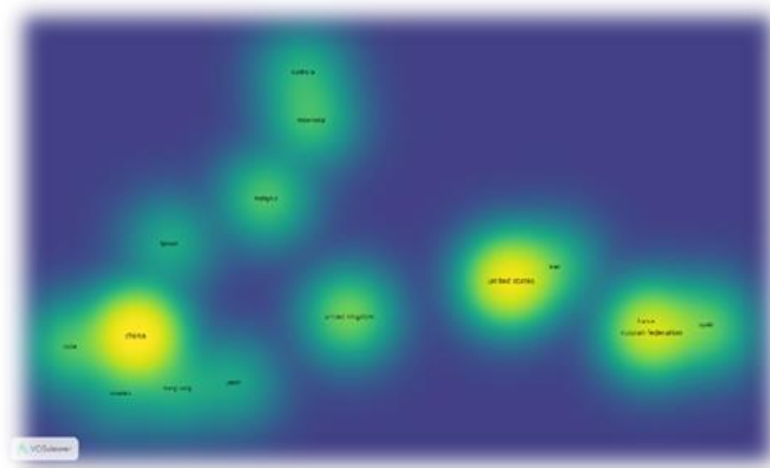
Figure 7: Co-authorship (Countries) in density visualisation map
(source: VOSViewer)

5.0 Conclusion

For the bibliometric investigation, we investigated the research on the relationship between Grammar and technology from 2015 to 2023. We primarily used data from the Scopus database and exclusively relied on internet platforms. The study examined five primary research inquiries. The data indicates a generally upward trend in research production, with intermittent variations that may require additional examination. The findings offer a thorough perspective on the chronological progression of research in the given subject from 2015 to 2023.

The bibliometric analysis found the authors who were most influential in the field of Grammar and technology. Further investigation of individual contributions and speciality areas could provide additional insights for future research initiatives. The data indicates varying contributions from different universities, with Kazan Federal University and Universiti Kebangsaan Malaysia emerging as the top performers in terms of publication count. This information is of great value to academics, institutions, and policymakers who are interested in comprehending the worldwide scope of grammatical studies and identifying prospective partners for future research initiatives. Furthermore, a wide range of sponsors signifies a comprehensive strategy towards enhancing language education in the nation.

The presence of 1112 network links and a combined link strength 2587 signifies a substantial degree of interconnectedness among the identified clusters. Hence, scholarly research on Grammar and technology often covers several subjects and demonstrates complex interrelationships among diverse aspects of the field. The visualisation map emphasises the importance of specific keywords and offers insights into concept connections. An in-depth comprehension of the co-occurrence and clustering of specific terms can provide a sophisticated insight into the intricate relationships within the Grammar research field. The results acquired from the density visualisation map might provide helpful assistance for future study attempts by guiding researchers in identifying areas of substantial interest and contention.

6.0 Implications of the Study

The noticeable upsurge in research output indicates a growing fascination with Grammar and technology research within the academic community. Researchers and stakeholders can gain valuable insights by analysing publication trends to identify specific areas of interest that have experienced a surge in attention over time. The anomalies, such as the decline in research output in 2018 and the subsequent decrease in 2023, suggest that external factors or specific events may have impacted research activity. An analysis of these components may provide significant insights into the conduct of the research community and the potential challenges faced during different periods.

The study's findings can facilitate the progress of inclusive research protocols within academic institutions. Recognising and promoting cooperative efforts and inclusiveness in research contributes to developing a culture that values many perspectives and encourages creativity. The information can assist scholars and institutions in discerning notable personalities and potential collaborators in the field. The clustering of luminosity around specific keywords indicates that researchers and scholars are particularly emphasising certain topics, such as pedagogical approaches, online learning, educational systems, and computer-assisted instruction. These sections might indicate contemporary trends or key areas for more investigation and advancement.

Paper Contribution to Related Field of Study

The contribution of this paper is related to the field of teaching and learning.

References

Aghaei Chadegani, A., Salehi, H., Yunus, M., Farhadi, H., Fooladi, M., Farhadi, M. and Ale Ebrahim, N.(2013), "A Comparison Between Two Main Academic Literature Collections: Web of Science and Scopus Databases", Asian Social Science, Vol. 9 No. 5, pp. 18-26.

Appio, F.P., Cesaroni, F. and Di Minin, A. (2014). "Visualising the Structure and Bridges of the Intellectual Property Management and Strategy Literature: A Document Co-Citation Analysis", Scientometrics, Vol. 101 No. 1, pp. 623-66.

Bikowski, Dawn. (2018). Technology for Teaching Grammar. 1-7. 10.1002/9781118784235.eelt0441.

Chomsky, N. (1957). Syntactic structures. Mouton

Crystal, David. (2002). Language and The Internet. Professional Communication, IEEE Transactions on. 45. 142-144. 10.1109/TPC.2002.1003702.

Danet, B., & Herring, S. C. (Eds.). (2007). The multilingual Internet: Language, culture, and communication online. Oxford University Press.

Di Stefano, G., Peteraf, M. and Verona, G. (2010), "Dynamic Capabilities Deconstructed: A Bibliographic Investigation Into the Origins, Development, and Future Directions of the Research Domain", Industrial and Corporate Change, Vol. 19 No. 4, pp. 1187-1204.

Dibekulu, Dawit. (2022). Teaching Grammar: In The View of Conventional Vs Contemporary Approach. X.

Fahimnia, B., Tang, C. S., Davarzani, H., & Sarkis, J. (2015). Quantitative Models for Managing Supply Chain Risks: A Review. European Journal of Operational Research, 247(1), 1-15.

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2021). Understanding the Role of Digital Technologies in Education: A Review. Sustainable Operations and Computers, 3, 275-285. https://doi.org/10.1016/j.susoc.2022.05.004.

Janaki Manokaran, Norizan Abdul Razak, & Afendi Hamat, (2023) Game-based learning in teaching grammar for non-native speakers: a systematic review. 3L; Language,Linguistics and Literature,The Southeast Asian Journal of English Language Studies., 29 (2). pp. 13-32. ISSN 0128-5157

Manning, C. D., & Schutze, H. (1999). Foundations of statistical natural language processing. MIT Press.

Meier, M. (2011), "Knowledge Management in Strategic Alliances: A Review of Empirical Evidence", International Journal of Management Reviews, Vol. 13 No. 1, pp. 1-23.

Tavakoli, M. (2021). Using Google Search for English Grammar Learning. Journal of Nusantara Studies (JONUS), 6(2), 318-339. https://doi.org/10.24200/jonus.vol6iss2pp318-339.

Van Eck, N.J. and Waltman, L. (2007), "Bibliometric Mapping of the Computational Intelligence Field", International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems, Vol. 15 No. 5, pp. 625-645.

Verbeek, A., Debackere, K., Luwel, M. and Zimmermann, E. (2002), "Measuring Progress and Evolution in Science and Technology – I: The Multiple uses of Bibliometric Indicators", International Journal of Management Reviews, Vol. 4 No. 2, pp. 179-211.

Wu, Y.C.J. and Wu, T. (2017), "A Decade of Entrepreneurship Education in the Asia Pacific for Future Directions in Theory and Practice", Management Decision. Vol. 55, No. 7, pp. 1333-1350.