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E-learning in French language learning: A bibliometric analysis using VOSviewer

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Abstract

This study investigates the development of French language learning and its relation to e-learning. The study employs a computational approach to bibliometric analysis using VOSviewer. The authors used the Publish or Perish application to collect scholarly sources from Google Scholar over the past ten years (2013–2023). The keywords "E-Learning," "Educational Application," and "French Learning" were used to identify relevant articles, resulting in 802 sources related to the topic. The results show that the four most frequently occurring terms are *e-learning*, *French*, *application*, and *education*. A total of 182 items were identified and grouped into seven clusters. The number of publications fluctuated from 2013 to 2020. In even-numbered years, there was a general increase in publications (56, 59, 66, and 73), while odd-numbered years showed a downward trend (47, 56, 60, and 73). In 2021 and 2022, there was a significant increase to 92 and 126 publications, respectively. In 2023, the number slightly decreased to 94 publications. The results of this study may serve as a foundation for future research on French language learning through e-learning and contribute to the growing body of literature on digital language education.

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INTRODUCTION

French is one of the international languages, with 300 million speakers (Reynard et al., 2022). Therefore, proficiency in French as a foreign language is regarded as essential. The study of French is categorized into three contexts: French as a Mother Tongue (FMT), French as a Foreign Language (FFL), and French as a Second Language (FSL) (Cadet & Guerin, 2012). FMT is taught in educational institutions in France, where French serves as the native language. In contrast, FFL is taught as a foreign language, typically in countries where French is not widely spoken (non-Francophone regions). Additionally, FSL is studied in Francophone countries (Boutin, 2019).

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As one of the world's fourth most widely spoken languages, the teaching of French continues to grow, both through traditional classroom instruction and e-learning modalities. The COVID-19 pandemic has further accelerated the adoption of e-learning across various educational contexts. Research on this subject has also expanded. While numerous studies exist on teaching French, there

remains a gap in research specifically addressing FFL in relation to the domains of science and technology and their development over time. A promising method for analyzing the progression of science and technology in the context of FFL is bibliometric analysis. This technique leverages metadata, enabling researchers to examine bibliographic content and citation trends in published articles and scientific journals.

Bibliometric analysis has been widely applied in diverse fields, such as economics (Bonilla et al., 2015; Castillo-Vergara et al., 2018; Firmansyah & Faisal, 2020; Rusydiana, 2019), chemical research (Grandjean et al., 2011; Modak et al., 2020), chemical engineering (Ho, 2012), materials science (Nandiyanto & Al Husaeni, 2021), bioenergy management (Soegoto et al., 2021), trends in scientific publications (Nandiyanto et al., 2020), robotic hand systems (Castiblanco et al., 2021), machine performance (Setiyo et al., 2021), nano-organic metal framework synthesis (Shidiq, 2022) and scientific publication trends (Mulyawati & Ramadhan, 2021). Its utility also extends to mapping research in specialized linguistic areas, such as socio-pragmatic linguistics (Rahman et al., 2024).

However, a review of the literature reveals no studies utilizing bibliometric analysis to investigate French language learning. This presents an opportunity to explore the evolution of research in French language studies, particularly over the past decade (2012–2022). The current study conducts computational research to map bibliometric trends in articles related to French language learning, indexed by Google Scholar, using VOSviewer software. This research aims to provide a new reference for language researchers, particularly those specializing in French, to identify potential collaborators and undertake further investigations in this field.

E-learning

Information and communication technology development today has provided many conveniences and possibilities in designing and developing an education system, especially online learning concepts, models, or E-learning. Hartley stated that e-learning is a type of teaching and learning that allows the delivery of teaching materials to students using the internet, intranet, or other computer network media. Through the internet, e-learning makes it easier for students to practice expanding their knowledge and insight. Some interpret e-learning as a form of distance education conducted through the internet (Haryanto, 2017).

The ILRT of Bristol University defines e-learning as using electronic technology to deliver, support, and enhance teaching, learning, and assessment. More specifically, Rosenberg defines e-learning as using internet technology to distribute learning materials so students can access them from anywhere (Racmadhany, 2022).

Habibullah et al. and Muflihah suggest that e-learning has several characteristics (Ait Ouaret, 2021), including:

- Interactivity (interactivity) is the existence of a large number of communication routes, namely direct (synchronous), in the form of messenger or chat, and indirectly (asynchronous), in the form of panels, guest books, and mailing lists.
- Independence (independence) is freedom in terms of time, place, energy, and subject matter. This characteristic causes teaching and learning activities to be student-centered (student-centered learning).
- Accessibility: The existing learning materials are easily accessible using the internet and have broader and faster access than conventional methods.

Enrichment, the material presented in learning activities, is also included as enrichment. These characteristics highlight the fundamental role of digital tools in modern education, a concept further explored in studies focusing on the integration of such tools in specific language teaching contexts (Kholis & Iryanti, 2021).

E-Learning in French as a Foreign Language (FFL)

Before the COVID-19 pandemic, the digitalization of learning media had developed. Online learning complements the broader classification of learning extensions, which include earlier technologies such as correspondence courses, educational television, and video conferencing (Means et al., 2009).

Many platforms offer French language learning: from French television to French learning sites and software/mobile applications. In e-learning, there is a critical area where the satisfaction of the learning model is found in the many interactions between the teacher and students (Orhan & Beyhan, 2020). French teachers can exploit several media in implementing e-learning, both in using video editing applications such as Loom and Screencast-O-Matic, as well as in conducting learning assessments such as Kahoot, Quizizz, Wordwall, Learningapps, and others (Racmadhany et al., 2021).

Leveraging Learning Management System (LMS) platforms such as Edmodo, Google Classroom, and Schoology can also simplify and enrich these interactions, even if they take place remotely and out of sync. However, using fun and motivating learning materials such as videos on the LMS platform is vital so that the learning process can occur two-way, where students and teachers can interact through discussion in the comments column (Darmawangsa & Racmadhany, 2019). The nature of these digital interactions is crucial for effective e-learning, extending to the dynamics of communication itself, as seen in research on linguistic incivility in student-lecturer interactions on digital platforms like WhatsApp (Rohali et al., 2024).

RESEARCH METHOD

This study's article data are gathered from various journals that Google Scholar has indexed since this platform is an open-source database. In searching for various data, Publish or Perish software is used to facilitate the search for hundreds of data. This software was used to conduct a literature review on the topics we selected. Some of the stages in this research are described in Figure 1.

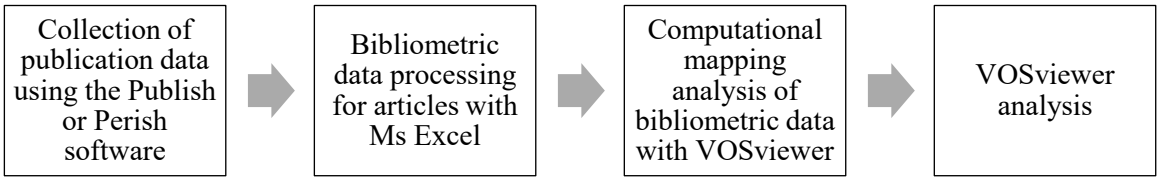

Figure 1. Research Stages

In this research process, four main steps are carried out to obtain research results, namely:

- search and collect data using Publish or Perish software through Google Scholar, where the data obtained is then stored in .csv and .ris formats. Google Scholar was chosen as the primary database due to its extensive coverage of scholarly literature across various disciplines, including open-access publications, making it a valuable resource for comprehensive bibliometric analysis. However, it is important to acknowledge that relying solely on Google Scholar might introduce limitations regarding the depth of indexing compared to specialized databases like Scopus or Web of Science.;
- hundreds of article data were then reprocessed using Microsoft Excel by dividing them into different years and making a list of the number of articles per year. Then proceed with making graphs so that changes are more visible every year;
- then performed a computational mapping analysis of bibliometric data of research information system (.ris) type from the previous Publish or Perish software using the VOSviewer application;
- the last step is to analyze the result data from the VOSviewer application.

All article data is obtained from the Publish or Perish software using the keywords "E-learning", "French Language", "Educational Application". These data were obtained in September 2022. The data obtained are articles published from 2012 to 2022 that meet the criteria for the analysis of this research, where the article data, as mentioned in the stages above, is exported into two different types of documents, which are research information systems (.ris) and comma separated value format (*.csv).

The specific search string used was "E-learning", "Educational Application", and "French Language". A total of 802 articles were initially retrieved. From this initial set, articles were screened to ensure their relevance to French language learning and e-learning. Criteria for inclusion involved direct relevance to the research scope, while exclusion criteria included non-academic sources, book chapters, conference proceedings not peer-reviewed, and articles outside the 2012-2022 publication range. Duplicate entries were systematically identified and removed, resulting in the final dataset for analysis. This rigorous screening process aimed to enhance the replicability of the study and bolster reader confidence in the data selection methodology.

The VOSviewer application analyzes the relationship between the terms used and visualizes and evaluates trends using bibliometric maps. When creating a bibliometric map, the keyword frequency is set to be found at least five times. Therefore, 229 terms and keywords that are less relevant were obtained and were then removed.

FINDINGS AND DISCUSSION

Published Data Search Results

Based on the search results using the Publish application or Perish manager based on the Google Scholar database, 802 articles were found that met the search criteria. The data is in the form of article metadata consisting of the author's name, title, year, journal name, publisher, number of citations, article links, and related URLs.

Table 1 below shows some examples of article publications using VOSviewer analysis. The sample of articles used is the most related to the keywords of this research. The number of citations per year for e-learning with educational applications in French Learning is 11273. Each author received an average of 14.07 citations per article, with an h-index of 46 and a g-index of 89. These metrics (h-index of 46 and g-index of 89) suggest a relatively mature and impactful research domain within the observed period, indicating a substantial body of highly cited work and productive authors contributing to the field of e-learning in French language learning. Such indicators are comparable to well-established sub-fields in applied linguistics and digital education, demonstrating a robust scholarly interest in this intersection.

Table 1. E-Learning with Educational Application in French Learning Publication

No.	Authors	Title	Year	Cites
1	Y Safsouf, K Mansouri, F Poirier	An analysis to understand the online learners' success in public higher education in Morocco	2020	37
2	J Heutte, PA Caron, F Fenouillet…	*Étude des liens entre les caractéristiques instrumentales et les différents types de motivations des participants dans un MOOC*	2016	22
3	M Ouadoud, MY Chkouri, A Nejjari	LeaderTICE: A Platforms Recommendation System Based on a Comparative and Evaluative Study of Free E-learning Platforms.	2017	21
4	J Wang, C Berger, N Szilas	Pedagogical design of an eTandem Chinese-French writing course	2012	17
5	O Chergui, A Begdouri, D Groux-Leclerc	A classification of educational mobile use for learners and teachers	2017	15
6	A Nobre	Multimedia technologies and online task-based foreign language teaching-learning	2017	14
7	C Gabarre, S Gabarre	Criteria for successfully recruiting online peer-tutors in foreign languages	2012	12

No.	Authors	Title	Year	Cites
8	MA Impedovo, FS Touhami…	Educational Technology in a French Teacher Training University: Teacher Educators' Voice	2016	10
9	N Shafiq, M Talbi	Tutoring functions in a blended learning system: case of specialized French teaching	2017	10
10	A Bissoonauth-Bedford, R Stace	Grappling with grammar on a virtual learning platform: the case of first year French students at the University of Wollongong	2012	9
11	A Bissoonauth-Bedford, R Stace	Building a writing community through learning of French	2015	9
12	M Nkenlifack, R Nangue, B Demsong…	*Approche de modernisation de l'enseignement des langues et cultures nationales du Cameroun à l'aide des TIC.*	2012	7
13	Y Nafidi, A Alami, M Zaki, H Afkar	Open and distance learning in the initial education of trainee teachers	2015	6
14	A Duguet, S Morlaix	Perception des TIC par les enseignants universitaires: l'exemple d'une université française	2017	6
15	L Ozturk	Functions and role of social media networks in learning a foreign language: A case study	2019	6
16	AJ Idrissi, K Berrada, R Bendaoud…	UC@ MOOC: A pedagogical innovation to face the challenges of massification in higher education	2018	5
17	T Magal-Royo, J Garcia Laborda, S Price	A New m-Learning Scenario for a Listening Comprehension Assessment Test in Second Language Acquisition [SLA]	2017	4
18	W Supper, F Guay, É Falardeau, T Karsenti	*La fréquence d'utilisation de la tablette numérique à des fins pédagogiques et le rendement scolaire des élèves*	2019	4
19	GH Jho, JH Jang, GS Sim	A Multimedia Tutorial system for Learning the French Language	2016	2
20	E KUŞÇU	Applications for Mobile Assisted French Learning: Duolingo And Memrise	2019	2
21	N Harianja, TR Soraya, H Fibriasari	Development of interactive multimedia on learning descriptive text for French learners in North Sumatra	2021	2
22	TR Soraya, N Harianja, H Fibriasari	Material Development in Production Ecrite Intermediaire by SIPDA to Improve the Writing Ability the Student of French Departement at Faculty of Languages and Arts at One of State Universities in Northen Island of Indonesia	2021	1

Research Developments in the Field of French

Table 2 shows the development of research in the field of e-learning in French learning published in the Google Scholar-indexed journal. Based on the data shown in Table 2, the total publications related to learning French using e-learning is 802. The lowest number of research publications was in 2013, with 47 publications. Meanwhile, the highest research publication will be in 2021, with 126

publications related to learning French through e-learning. Even though in 2022 there were only 94 publications, it should be underlined that the data collection in this study took place in September 2022, so that the number of publications by the end of 2022 could still increase.

This overall growth pattern, particularly the significant increase from 2020 to 2021, strongly correlates with the global acceleration of digital education due to the COVID-19 pandemic. Similar trends have been observed in broader studies on technology integration in language education, a phenomenon consistent with established theories of rapid technological adoption and pedagogical shifts in response to major societal disruptions (Hodges et al., 2020), suggesting that the pandemic acted as a catalyst for research in e-learning modalities across various foreign languages.

Table 2. Number of Publications from 2012 to 2022

Year of publications	Number of publications
2012	56
2013	47
2014	59
2015	56
2016	66
2017	60
2018	73
2019	73
2020	92
2021	126
2022	94
TOTAL	802

Furthermore, Figure 1 shows the development of e-learning research in French learning over the last decades (from 2012 to 2022). The number of e-learning research in French learning from 2012 to 2018 experienced fluctuations, where the number of publications in Even years (2012, 2014, 2016, 2018) tended to be high, sequentially 56,59, 66, 73 publications. While in odd years (2013, 2015, 2017), there was a downward trend at 47, 56, and 60 issues. The number of publications in 2019 was the same as in 2018, which was 73. Furthermore, in 2020 and 2021, there was a significant leap of 92 and 126 publications. The most popular research on e-learning in French learning occurred in 2021, comprising 126 published articles.

This demonstrates a fluctuating but generally upward trajectory in scholarly interest, culminating in a significant surge during the pandemic era. Such growth patterns are often indicative of emerging research paradigms, necessitating a deeper exploration of the thematic shifts that accompany increased publication volume.

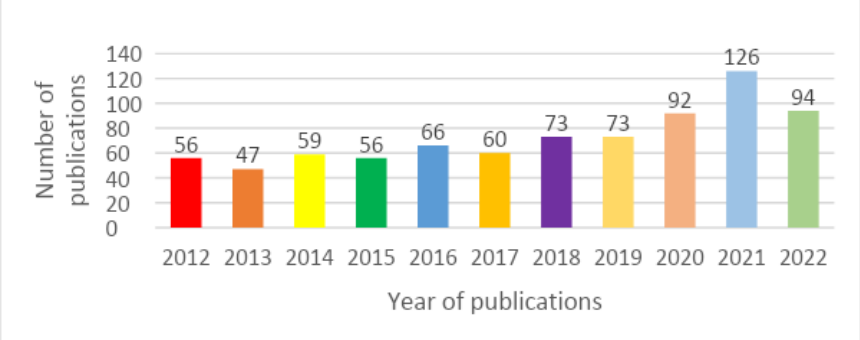

Figure 2. Level of Development in E-Learning in French as a Foreign Language Research

Visualization e-learning in French as a Foreign Language topic area using VOSviewer

In computational mapping to analyze the data obtained, the VOSviewer application is used. From the results of the computational mapping obtained, 182 items were found. Each item found related to learning French through e-learning is divided into 7 clusters such as:

- Cluster 1 (red) has 36 items: access, adaptation, approach, article, assessment, book, case study, communication, communication technology, concept, creation, effect, evaluation, future direction, ICT, impact, implication, information, internet, literature, methodology, paper, possibility, possible application, questionnaire, research, self, service, smartphone, social medium, text, translation, user, validation, and website. This cluster appears to encompass the foundational and methodological aspects of e-learning research, focusing on implementation and assessment. It reflects a primary concern with the practical elements of digital learning environments and their broader implications.
- Cluster 2 (green) has 30 items: alliance franchise, application domain, aspect, community, context, culture, data, domain, e-learning platform, focus, framework, higher education, intention, management, mobile app, mobile application, model, organization, overview, practice, quality, relationship, role, rule, strategy, system, tool, web, and work. This cluster delves into the strategic and systemic elements of e-learning within higher education, particularly highlighting platforms, models, and organizational aspects. The presence of "alliance franchise" and "culture" suggests an interest in the socio-cultural and institutional contexts influencing the adoption and management of e-learning in French.
- Cluster 3 (blue) has 27 items: ability, activity, app, attitude, child, educational application, effectiveness, experience, game, interaction, intervention, language, learner, mobile device, module, perception, recommendation, review, serious game, student, study, success, support, teacher technology, time, and use. This cluster focuses on the learner-centric aspects and the direct application of educational technologies. Terms like "game," "serious game," "interaction," and "mobile device" strongly emphasize engaging and practical digital tools for students, with a clear pedagogical focus on improving abilities and experiences. This suggests a research trend towards the practical implementation and evaluation of learning outcomes facilitated by technology.
- Cluster 4 (yellow) has 27 items: class, comparison, e-learning, foreign language, formation, *français, française,* French, French-speaking, HTTP, initiative, journal, knowledge, language teaching, *langue française, l'apprentissage,* learning, level, ligne, platform, process, program, programme, simulation, skill, task, and technique. This is evidently the core linguistic and pedagogical cluster, directly addressing French language teaching and learning within e-learning contexts. The co-occurrence of "French" with "foreign language," "language teaching," and *"l'apprentissage"* underscores the central research questions revolving around how French is acquired and taught in digital settings. "Platform" and "process" also indicate interest in the operational aspects of delivering French e-learning.
- Cluster 5 (purple) has 26 items: case, challenge, classroom, comparative study, content, contribution, digital technology, distance learning, e-learning tool, educational technology, example, experiment, form, France, French university, innovation, MOOCs, moodle, motivation, pilot study, report, school, teaching, and university. This cluster highlights the challenges and innovations in implementing digital and distance learning, particularly within French educational institutions. Terms like "MOOCs," "Moodle," "innovation," and "challenges" suggest focusing on advanced e-learning formats and the obstacles encountered during their adoption. The emphasis on "comparative study" indicates an interest in evaluating different approaches and technologies.

- Cluster 6 (turquoise) has 20 items: analysis, computer, course, development, future, higher education institution, industry, management system, MOOC, online course, participation, pedagogy, performance, problem, project, seminar, solution, survey, training, and workshop. This cluster leans towards the broader organizational and professional development aspects of e-learning, with a significant presence of terms related to "higher education institution," "management system," and "training." This suggests research addressing the administrative and structural support required for sustainable e-learning initiatives in French.
- Cluster 7 (orange) has 16 items: change, COVID-19, distance, distance education, education, educational institution, educational system, e-learning, environment, French language, implementation, online learning, pandemic, term, theory, and world. This cluster directly addresses the impact of global events, notably the COVID-19 pandemic, on the adoption and transformation of e-learning and distance education in French language contexts. It highlights the rapid changes to educational systems and environments driven by external factors.

The mapping visualization analyzed in this study consists of 3 parts: network visualization (see Figure 3), density visualization (see Figure 4), and overlay visualization (see Figure 5). Figure 3 shows the relationship between one term and another in the seven existing clusters. Labels are assigned to each term with colored circles. The circle size for each item varies depending on the frequency with which the item appears. The size of the label circle shows a positive correlation with the occurrence of the term in the title and abstract. The more often the term is found, the larger the label size.

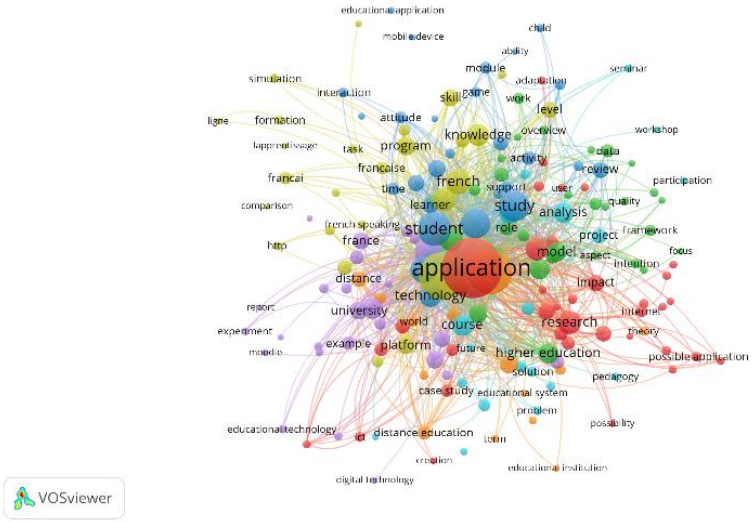

Figure 3. Network Visualization of E-Learning in French Language Learning

Figure 3 above shows the relationship between the terms that appear. The picture shows research topics that are often carried out related to e-learning in French language learning. From the clusters in the network visualization image above, research on e-learning in French learning can be divided into four areas, namely the "French" term, which is included in cluster 4 with 124 links and a total link strength of 382 and 67 occurrences (see Figure 6). The second term is "e-learning," which is still in cluster 4 with 175 links, 1185 total link strength, and 217 occurrences (see Figure 7). The third term is an "application" which is in cluster 1 with 178 links, 1767 total link strength, and 347 occurrences (see figure 8), and the last is the "education" term with 175 links, 1125 total link strength, and 206 occurrences in cluster 7 (see figure 9).

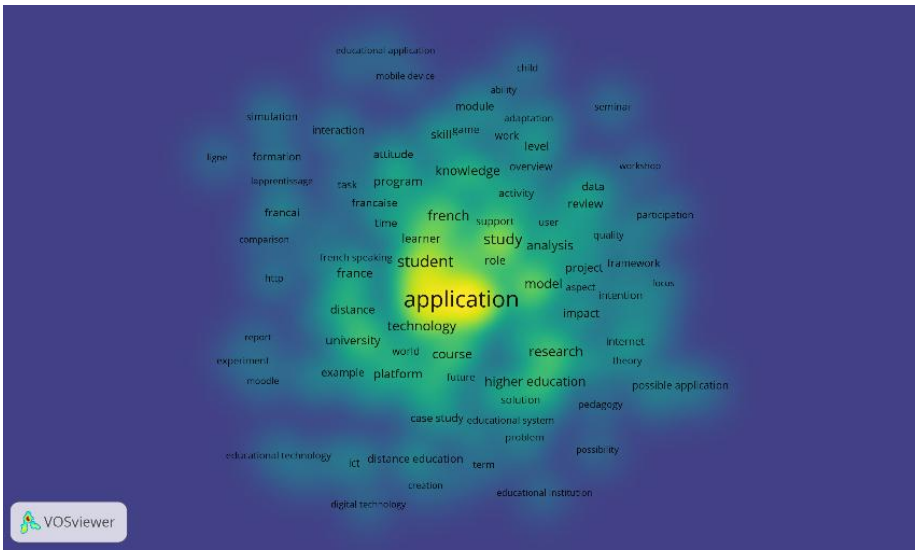

Figure 4. Density Visualization of E-Learning in French Language Learning

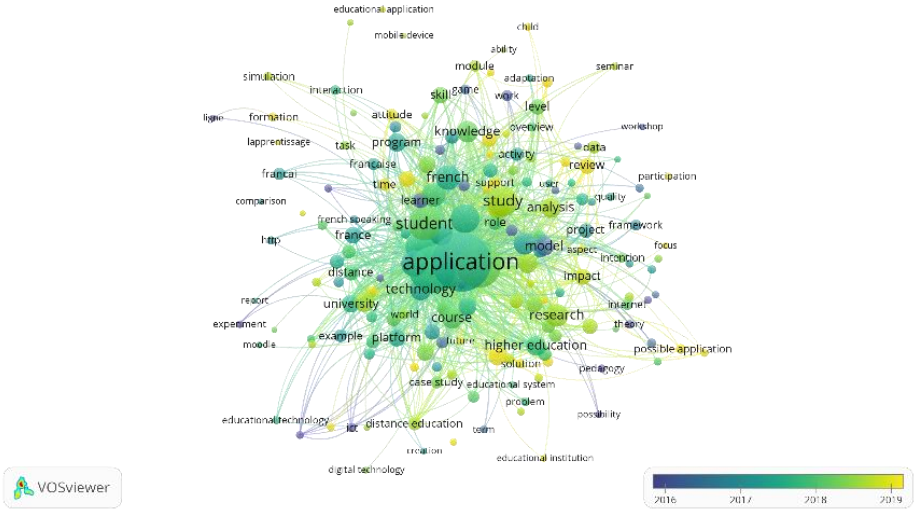

Figure 5. Overlay Visualization of E-Learning in French Language Learning

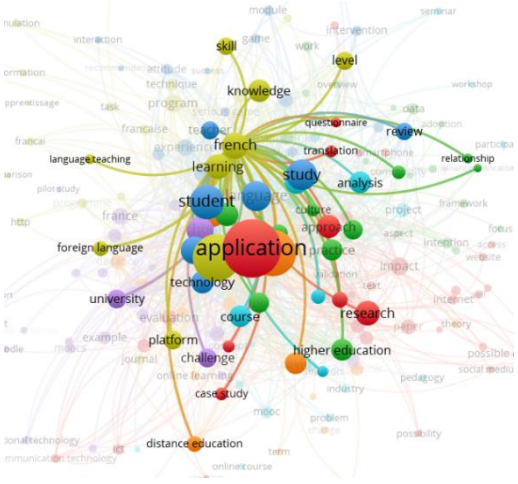

Figure 6. Network Visualization of French Terms

The dominance of these four terms ("French", "e-learning", "educational application", and "education") underscores the primary focus of the existing literature. While their high frequency confirms the core subject matter, the interpretive analysis of their interconnectedness within the clusters reveals underlying pedagogical approaches and technological tools that shape the field. For instance, the strong association between "French" and "e-learning" (both in Cluster 4) suggests a pervasive integration rather than isolated study. Comparing this dominance to bibliometric analyses in other foreign language learning contexts would further illuminate the unique or shared characteristics of French e-learning research. Additionally, future research could explore less dominant but emerging terms to identify under-researched areas, such as the long-term effectiveness of specific e-learning tools for different French proficiency levels, or the socio-cultural impact of technology on French language acquisition beyond pedagogical outcomes.

The density visualization in Figure 4 above shows that the more extensive the diameter of the term label circle and the brighter the yellow color, the more often the term appears (Schrlau et al., 2016; Nandiyanto & Al Husaeni, 2021). The explanation before means that much research on related terms has been done. On the other hand, if the color of the term fades close to the background color, which tends to be green or even blue, then the number of studies on the term is negligible. Based on Figure 4, it can be seen that research related to the terms application, study, student, French, and technology has a high number of studies. This finding, indicative of saturation in certain research areas, aligns with patterns observed in other bibliometric studies where well-established concepts tend to accumulate a higher density of publications over time (e.g., Rahman et al., 2024, in socio-pragmatic linguistics). The prevalence of these terms suggests a foundational interest in the practical implementation and immediate impact of e-learning tools on French language learners. However, this also implies a potential gap in more theoretical or longitudinal studies, or those exploring nuanced aspects beyond initial adoption and basic effectiveness.

Figure 5 shows an overlay visualization of e-learning research in French learning. The description of this visualization shows the novelty of research on related terms (Nandiyanto & Al Husaeni, 2021). Figure 5, which is clarified in Figure 10 below, shows that research on the French language was mainly carried out from 2017 to 2018, so the novelty of research on the French language tends to be low because its popularity period took place around 5 years ago. Meanwhile, in Figure 11, it can be seen that the term Covid is a term that has a very high novelty and is still related to teaching, learning, French, online learning, distance education, and others. Knowing this, we can easily do new research about learning French. The overlay visualization, especially highlighting "Covid" as a term with high novelty (Figure 11), corroborates the earlier observation regarding the pandemic's impact as a catalyst for e-learning research in French. This rapid emergence of "Covid" as a central theme in recent years is consistent with broader bibliometric trends in education and technology, where global events often drive new research frontiers. Conversely, the lower novelty of "French language" research (Figure 10) suggests that while French remains a core subject, the approaches to studying it, particularly through e-learning, are evolving. This shift indicates a transition from general French language studies to more specialized investigations of digital tools and their pedagogical implications within FFL contexts. This comparison between established and emerging themes provides a crucial benchmark for identifying fertile ground for future scholarly contributions.

Figure 6 shows the French relationship network with other terms, which are learning, application, student, study, knowledge, skill, level, questionnaire, translation, review, relationship, analysis, culture, approach, practice, research, higher education, case study, distance education, challenge, technology, platform, university, foreign language, teacher, and language teaching. The extensive network around the "French" term (Figure 6) highlights its central role as the subject of study, interconnected with various pedagogical (learning, teaching), technological (application, technology, platform), and institutional (higher education, university) aspects. This interconnectedness suggests a multifaceted research interest, covering the foundational elements of French language instruction and the innovative ways technology is applied.

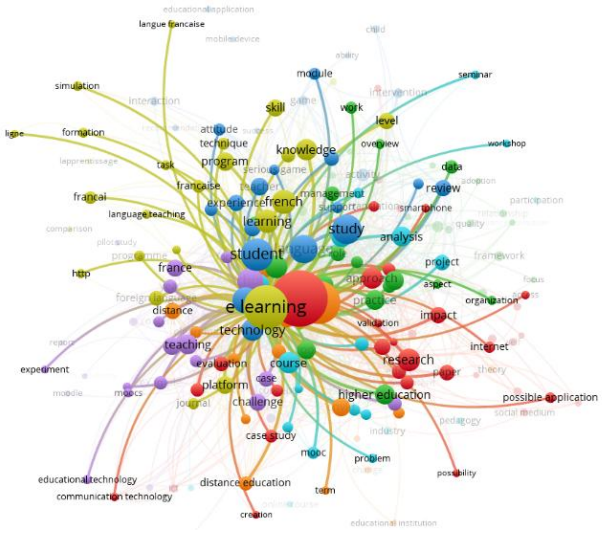

Figure 7. Network Visualization of E-Learning Terms

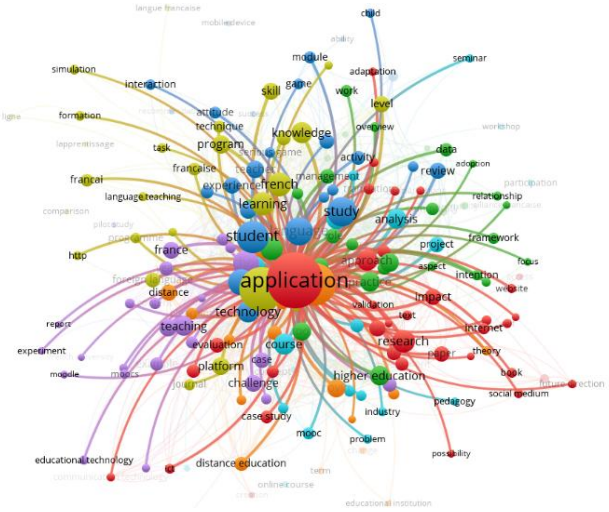

Figure 8. Network Visualization of Application Terms

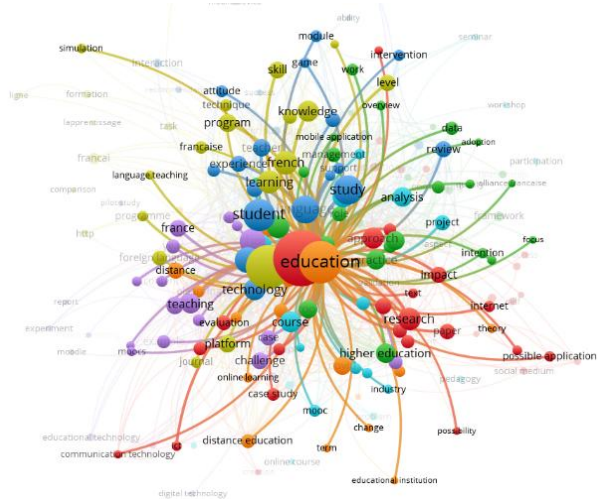

Figure 9. Network Visualization of Education Terms

In comparison, in Figure 7, the network of e-learning relationships is related to the term student, technology, learning, French, France, course, teaching, skill, knowledge, technique, attitude, language française, simulation, formation, task, français, module, work, level, seminar, workshop, overview, data, review, smartphone, analysis, project, organization, internet, impact, validation, research, possible application, higher education, MOOC, term, problem, creation, distance education, case study, platform, evaluation, educational technology experiment, and communication technology. The dense network around "e-learning" (Figure 7) further emphasizes its pervasive integration into French language education. The wide array of associated terms, from specific tools like "smartphone" and "MOOC" to pedagogical concepts like "skill" and "attitude," indicates a comprehensive investigation into the various facets of digital learning. This aligns with a broader trend in digital pedagogy that explores the full spectrum of e-learning's capabilities and challenges across different educational levels and learning outcomes.

While Figure 8 shows the application relationship network, which relates to the term student, French, study, learning, experience, program, knowledge, franchise, technique, skill, game, module, simulation, interaction, formation, task, language teaching, adaptation, child, seminar, activity, data, review, analysis, framework, relationship, project, aspect, intention, HTTP, moodle, MOOCS, platform, course, research, pedagogy distance education, educational technology, distance, technology, teaching, France, case study, and problems. The "application" network (Figure 8) specifically illuminates the practical and tool-centric focus within e-learning research for French. The strong links to terms such as "game," "simulation," and "interaction" suggest a significant research interest in developing and evaluating engaging and effective digital applications that facilitate French language learning. This focus on specific tools and their impact on learner experience reflects a contemporary trend in digital pedagogy to move beyond theoretical discussions to practical implementation and assessment.

In Figure 9, the term education intersects with the previous terms, namely e-learning and education. The interconnection of "education" (Figure 9) with "e-learning" and "educational application" highlights a critical understanding that these technological modalities are fundamentally embedded within broader educational contexts. This reinforces the idea that e-learning is not merely a technological add-on but an integral component of the evolving educational system for French language learning.

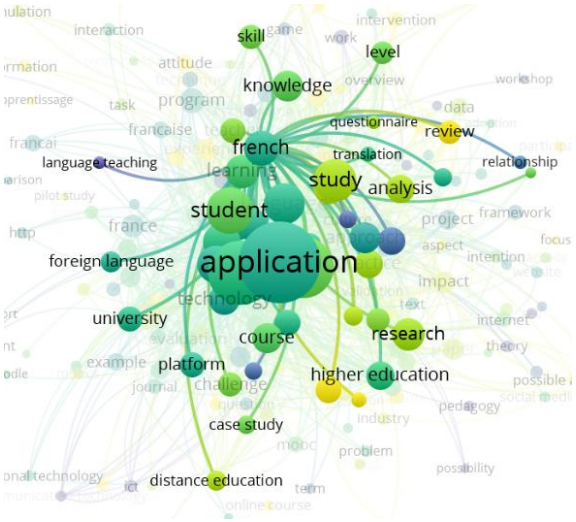

Figure 10. Research Novelty Related to the French Terms

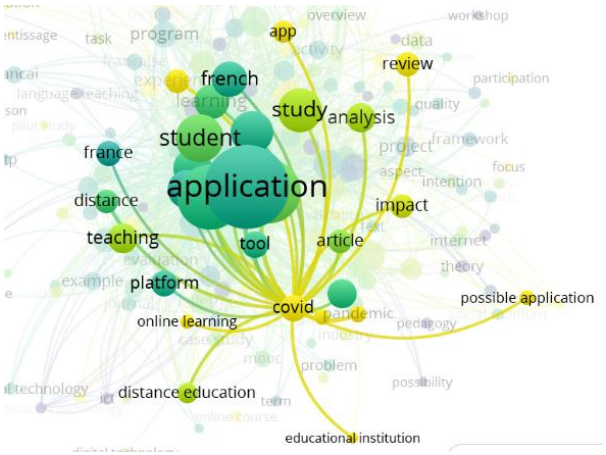

Figure11. The Term Covid is One of the Most Recent Research Terms

From these data, it can be seen that learning French is not much related to other terms. From the mapping results, learning French with French terms only has 124 links and is connected to 26. In contrast, French learning, related to e-learning, tends to have a high level of relevance and is often associated with various terms. It can be concluded that the field of learning French is still very likely to be researched and associated with other terms; this will have a higher impact on the novelty of the research. This observation suggests a shift in the research focus: while "French" as a linguistic subject remains constant, the innovative and impactful research now predominantly occurs at the intersection of French language education and e-learning technologies. This pattern is consistent with the evolution of many academic fields where interdisciplinary approaches lead to new insights and higher research impact. Therefore, future studies should capitalize on this trend by exploring novel connections, such as the effectiveness of AI-driven French language tutors, the ethical implications of using big data in French learner assessment, or the cultural nuances of digital communication in French, to further enhance the novelty and theoretical contribution of research in this area.

Based on the results of mapping the collected article data, it can be seen that the keyword e-learning in French learning is still rarely used in research. Most studies use terms or fields related to education, e-learning, and education. From the results of this study, we can look for research on e-learning in French language learning that is more up-to-date.

CONCLUSION

To determine the development of French research as a foreign language and its relationship to e-learning, we can use a bibliometric analysis computational approach with VOSviewer. The keyword "E-Learning, Educational Application, French Learning" in searching for related article titles is one of the keys to finding various articles from the Google Scholar database using the Publish or Perish application. From the duration of the research for the last 10 years (2012 to 2022), 802 articles related to e-learning in French Language Learning were found. During the last 10 years, there has been a fluctuation in the number of publications related to this theme. From 2012 to 2019, there were ups and downs in the number of publications.

Furthermore, in 2020 and 2021, there was a significant increase in 92 and 126 publications. Moreover, this year, there are 94 publications, which can increase. The results of this study can be used as primary research related to learning French with e-learning. From the clusters found, research on e-learning in French language learning can be divided into four areas, namely the French term, which has 124 links and a total link strength of 382, and 67 occurrences. The second term is e-learning, with 175 links, 1185 total link strength, and 217 occurrences. The next term is an application with 178 links, 1767 total link strength, and 347 occurrences, and the last is the education term with 175 links, 1125 total link strength, and 206 occurrences. From the results of this study, we can find out what terms are related to e-learning in foreign language learning, especially French. So that new

ideas related to science and technology can continue to be carried out in the development of language research.

The findings from this bibliometric analysis offer significant insights into the evolving landscape of French language learning within digital environments. The consistent prominence of terms like "French," "e-learning," "educational application," and "education" indicates a robust and integrated research focus. This suggests that the field is maturing beyond initial explorations of e-learning's potential, moving towards a deeper understanding of its specific applications and pedagogical implications in French language acquisition. The observed surge in publications during 2020-2021, clearly influenced by the COVID-19 pandemic, highlights the adaptability and rapid expansion of digital pedagogy in response to global shifts. Conversely, the analysis of term novelty reveals that while general "French language" research might appear less novel, the intersection of French learning with specific e-learning tools and the impact of recent global events (like "Covid") presents fertile ground for new inquiries, indicating a shift towards more specialized and contemporary research directions.

Based on these findings, this study proposes several avenues for future research. Firstly, there is a need for more empirical studies that evaluate the long-term effectiveness of specific e-learning tools and platforms in fostering different French language proficiencies (e.g., oral production, written comprehension). Secondly, given the increasing integration of technology, future research could explore the socio-cultural dimensions and ethical implications of AI-driven tools or large datasets in French language assessment. Thirdly, investigations into less dominant but emerging themes identified in the cluster analysis could reveal novel pedagogical models or under-researched areas of French e-learning. For example, studies focusing on personalized learning paths for diverse learner needs or comparative analyses of e-learning adoption in different Francophone and non-Francophone contexts would significantly enrich the field. This would move beyond merely descriptive analyses to contribute more theoretically relevant insights and practical recommendations.

It is important to acknowledge certain limitations of this study. The reliance solely on the Google Scholar database may exclude relevant articles indexed exclusively in other academic databases (e.g., Scopus, Web of Science), potentially affecting the comprehensiveness of the retrieved data. Additionally, the study did not apply filters based on specific publication types (e.g., journal articles only vs. conference papers), which might introduce variability in the rigor and depth of the included literature. Future bibliometric studies could address these limitations by incorporating multiple databases and stricter filtering criteria to provide an even more robust mapping of the research landscape.

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