

Trend Analysis of Arabic Digital Dictionaries: A Systematic Literature Review

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Abstract

This study aims to analyze research trends related to Arabic digital dictionaries through a Systematic Literature Review (SLR). The rapid development of digital technology has shifted the use of printed Arabic dictionaries toward digital and mobile-based dictionaries, which are widely utilized in Arabic language learning contexts. This study reviews 14 selected journal articles published between 2020 and 2024 that discuss the design, effectiveness, perception, and lexicographical quality of Arabic digital dictionaries. The review process followed systematic stages including identification, screening, eligibility assessment, and synthesis of findings. The results show that most studies agree that Arabic digital dictionaries are effective in improving vocabulary mastery and supporting independent learning due to their practicality and accessibility. However, many studies also highlight significant limitations, particularly the lack of contextual meaning, morphological (şarf), and syntactic explanations, which may lead to surface-level learning. Furthermore, several studies emphasize the importance of applying principles of pedagogical lexicography in digital dictionary development. This review identifies research gaps regarding the integration of artificial intelligence and deeper linguistic features into Arabic digital dictionaries. The findings are expected to contribute to future research and development of more comprehensive and pedagogically sound Arabic digital dictionaries.

Keywords: Arabic Digital Dictionary; Vocabulary Learning; Lexicography; Systematic Literature Review; Arabic Language Learning.

INTRODUCTION

The development of digital technology has brought significant changes to Arabic language learning, particularly in the use of linguistic learning resources. Digitalization not only facilitates access to learning materials but also influences learning strategies and the way learners understand mufradāt (vocabulary). One medium that has developed rapidly is the Arabic digital dictionary, whether Android application-based, web-based, or on other online platforms. Digital dictionaries are increasingly used because they offer easy access, fast meaning search, and additional features such as pronunciation audio and instant search, making them considered more practical than printed dictionaries (Sabirin, 2021; Wargadinata et al., 2022).

Various studies show that the use of digital dictionaries can improve vocabulary mastery and support learners' independent learning. A number of studies indicate that digital dictionaries offer various advantages, including search speed, ease of access via

smartphone, and additional features such as pronunciation audio, automatic translation, and root-word-based search. This convenience provides a more flexible learning experience suited to the characteristics of the modern generation of learners. Digital-generation learners prefer online dictionary applications over traditional printed dictionaries, because applications offer easier navigation and additional features such as audio (Wargadinata, 2022). Digital dictionary applications enable learners to look up word meanings independently without direct reliance on a teacher, and align with the characteristics of a digital generation familiar with technology (Rizqia, 2023; Ilham, 2023). Nevertheless, a number of studies also reveal that most digital dictionaries are still oriented toward literal translation and do not yet provide adequate linguistic information, such as sentence context, usage examples, and morphological (şarf) and grammatical structure analysis (Suwardy, 2022; Haryati et al., 2023).

The development of Arabic digital dictionaries in the digital era requires the application of clear lexicographic standards so that dictionaries function not only as translation tools but also as accurate and educational language learning resources. Lexicographically, an ideal Arabic dictionary is compiled based on lemma consistency, precision of meaning, and completeness of linguistic information covering root words, wazan (morphological patterns), and context of use (Al-Qasimi, 1991; Ni'mah, 2019). However, various studies show that most Arabic digital dictionaries currently in circulation are still oriented toward literal translation and search speed, while aspects of entry microstructure, contextual sentence examples, and the integration of nahwu (syntax) and sharaf (morphology) have not been optimally fulfilled (Zahrah et al., 2021; Haryati et al., 2023). This condition indicates that the application of Arabic dictionary standards on digital platforms still faces serious challenges, which affects the quality of learners' vocabulary comprehension and has the potential to produce surface-level Arabic language learning (Suwardy, 2022). In digital dictionaries, lexicographic principles are becoming increasingly important given that users rely on speed, accuracy, and completeness of meaning information when searching for words. Haryati et al. (2023) affirm that analysis of digital dictionary applications such as *Al-Kamus* must consider aspects of meaning precision, dictionary typology, and lemma microstructure, since a dictionary that does not meet these standards "cannot yet be categorized as an ideal dictionary because the precision aspect has not been fulfilled, particularly when a lemma is not equipped with supporting illustrations." This finding indicates that the development of digital dictionaries still faces challenges in fulfilling modern lexicographic principles, especially in formulating clear definitions, presenting contextual meaning, and providing additional information such as example sentences and linguistic features.

This limitation is an important issue given that Arabic has high morphological complexity, in which changes in word form and wazan patterns greatly affect meaning. Reliance on digital dictionaries that do not present sharaf information comprehensively has the potential to produce shallow and non-contextual understanding (Sidkiyah et al., 2022). Therefore, the quality of digital lexicography is a crucial aspect that needs to be evaluated, particularly regarding lemma consistency, precision of meaning, and completeness of dictionary entry microstructure.

Although research on Arabic digital dictionaries continues to develop, most studies remain partial, focusing on descriptions of use, user perceptions, or the development of specific applications. Studies that systematically map research trends, findings tendencies, and research gaps in the study of Arabic digital dictionaries remain

limited. This condition indicates the need for a comprehensive scientific synthesis to provide a complete picture of the development of Arabic digital dictionary research in recent years. Therefore, this study aims to analyze research trends on Arabic digital dictionaries through a *Systematic Literature Review* (SLR) approach, by mapping the focus of study, key findings, and identifying remaining research gaps as a basis for the future development of research and applications of Arabic digital dictionaries.

METHOD

The results of this Systematic Literature Review (SLR) are expected to provide a comprehensive picture of research trends, lexicographic quality, and the application of Arabic dictionary standards in digital dictionaries within the context of Arabic language learning. The SLR method was chosen because it is able to systematically and transparently synthesize previous research findings to produce a comprehensive understanding of a field of study (Kitchenham et al., 2009). This study uses data from various scientific literature published between 2020–2024 in the form of national and international journal articles. All data were analyzed descriptively-qualitatively to summarize and interpret the key findings relevant to the research focus (Retnawati et al., 2018).

The research procedure was carried out through several stages, the first and second stages included the determination of data sources as well as the search and selection of literature conducted online through the Google Scholar database and SINTA-indexed journals. This process aimed to broadly capture relevant research while remaining methodologically controlled (Perry & Hammond, 2002). Literature selection was carried out based on publication year criteria (2020–2024) and relevant keywords, including “Arabic digital dictionary”, “Arabic digital dictionary”, “Arabic language learning”, “digital lexicography”, and “vocabulary mastery”.

The third and fourth stages consisted of the data collection process and the determination of article eligibility based on inclusion and exclusion criteria. Establishing these criteria was important to ensure that the reviewed articles had topic relevance and adequate methodological quality (Petticrew & Roberts, 2006). Inclusion criteria covered articles discussing Arabic digital dictionaries or technology-based vocabulary search media in the context of Arabic language learning, having a clear methodology, and being available in full-text form. Articles that were not relevant to the research topic, did not meet the methodological criteria, or were duplicate publications were excluded from the review. The selection process was carried out by reviewing the title, abstract, keywords, methodology, and research results.

The final stage was data presentation and synthesis. Articles that passed the selection process were analyzed using thematic analysis techniques to identify research trends, digital dictionary feature characteristics, effectiveness of use, and the appropriateness of the application of Arabic lexicography standards. The analysis results are presented in the form of descriptive narrative and a summary table to provide a systematic picture of the development of Arabic digital dictionary research and remaining research gaps. All stages of this research were structured following SLR reporting principles based on the PRISMA guidelines to ensure transparency and reproducibility (Moher et al., 2009).

RESULTS AND DISCUSSION

Based on the researcher's analysis and review of 14 scientific articles that met the inclusion criteria and were selected, the following is an illustration of the literature search process through the Google Scholar database and SINTA-indexed journals. The findings and discussion diagram show that of approximately ± 400 articles obtained through the Google Scholar search, 14 articles were determined to meet the inclusion criteria and were analyzed in this study. The analysis results show that research on Arabic digital dictionaries is dominated by descriptive studies emphasizing practicality and user perception. Most digital dictionaries are considered effective in helping vocabulary mastery and supporting independent learning, but still have limitations in presenting contextual meaning, morphological analysis, and lexicographic consistency. Therefore, these SLR results affirm the importance of developing Arabic digital dictionaries that are not only technology-based, but also refer to pedagogical lexicography standards in order to comprehensively improve Arabic language competence.

Based on the researcher's analysis and review of 14 scientific articles that met the inclusion criteria and were selected, the following is an elaboration of the meta-analysis of these articles related to the trend analysis of Arabic digital dictionaries in Arabic language learning.

Table 1. The Meta-Analysis Of Articles and Trend Analysis Of Arabic Language Learning

No	Code	Researcher	Title	Method	Main Findings
1	A	Aprilia, Massofia & Hasaniyah (2022)	Pemanfaatan Media Digital dalam Pembelajaran Bahasa Arab di Perguruan Tinggi	Descriptive qualitative	digital dictionaries speed up vocabulary search, but most applications are still literal translations without support for sentence context and sharaf.
2	B	Zahrah, Wargadinata & Barry (2022)	Kamus Digital dan Pengembangan Keterampilan Berbahasa Arab pada Generasi Z	Mixed-method	digital dictionaries effectively speed up word search, but understanding of contextual meaning remains weak.
3	C	Agussalim, Baso & Zuhriah (2023)	<i>Penggunaan Almaany dalam Pembelajaran Mufradāt</i>	Case study	Almaany is popular due to fast access, but weak in meaning accuracy and contextual examples.
4	D	Ramadhan Nur Ilham (2023)	Pemanfaatan Kamus Digital Bahasa ArabIndonesia Sebagai Sumber Belajar di SMP IT Ibnu Khaldun	Correlational qualitative	there is a positive relationship between digital dictionary use and students' learning independence.
5	E	Suwardy (2022)	<i>Effectiveness of Digital Dictionary Application.</i>	Experiment	digital dictionaries significantly improve vocabulary mastery, but do not help understanding of wazan and sharaf.
6	F	Ristek Muslim Study (2024)	<i>E-Dictionary Vocabulary Mastery.</i>	Systematic mapping	identifies five research trends: mobile applications, digital dictionaries, linguistic AI, gamification, and digital literacy.

continued

7	G	Ab. Rahim dkk (2024)	<i>A Smartphone Application for Learning Arabic Vocabulary: A Comprehensive Systematic Review</i>	systematic review (PRISMA)	groups findings into three main themes and emphasizes the need for specific design and evaluation criteria for Arabic vocabulary.
8	H	R. Taufiqurochman, Nur Yasin Sirotol Mustaqim (2023)	<i>Digital Indonesian Arabic Dictionary For Improving Mastery Of Arabic Vocabulary</i>	KQuantitative	users' vocabulary mastery increased significantly, with positive ratings for the interface and search features.
9	I	Suprianto & Nur Toifah (2024)	Efektivitas Penggunaan Artificial Intelligence (AI) dalam Pembelajaran Bahasa Arab di Era Society 5.0: Systematic Literature Review	qualitative with concept analysis	AI effectively supports Arabic language learning, particularly in text correction, translation, and increasing learning motivation.
10	J	Ahmad Zaki Alhafidz (2023)	Eksistensi Kamus Cetak Bahasa Arab di Era Digital	descriptive survey research	students prefer digital dictionaries for their practicality, but printed dictionaries remain important as scholarly heritage.
11	K	Haryati, dkk. (2023)	<i>Analisis Tipologi Mobile Dictionary Al-Kamus dengan Pendekatan Leksikografi</i>	Document analysis / Lexicographic study	Al-Kamus meets the criteria of ease of use and completeness, but does not yet meet the criterion of meaning precision.
12	L	Andi Agussalim, Yusring Sanusi Baso & Zuhriah	Perancangan Kamus Digital Linguistik-Arab Berbasis Windows dan Android	Research and Development (R&D) method	the developed digital dictionary application is considered feasible and effective in helping beginners understand Arabic linguistic terms.
13	M	Saproni Muhammad Samin, Yenni Yunita, Ismail Akzam, Susanto, & Fauzi Azmi (2021)	Strategi Peningkatan Kemandirian Belajar Mahasiswa Pendidikan Bahasa Arab di Era Revolusi Industri 4.0	Qualitative research with a descriptive approach	students' learning independence can be improved through Student-Centered Learning, e-learning, and an Arabic-speaking environment.
14	N	Ahmad Arifin & Slamet Mulyani (2021)	Persepsi Mahasiswa terhadap Penggunaan Kamus Digital Bahasa Arab di Era Society 5.0	descriptive exploratory research	although many use digital dictionaries, students' translation ability remains relatively low.

Based on the results of the Systematic Literature Review of 14 articles, it can be concluded that Arabic digital dictionaries play an important role in Arabic language learning, particularly in improving the efficiency of vocabulary search and supporting learners' independent learning. Digital dictionaries are widely used due to their practicality and accessibility, and have proven effective in improving mufradāt mastery. However, most studies show that digital dictionaries still have limitations, particularly in

the presentation of contextual meaning, usage examples, and in-depth linguistic information such as sharaf and wazan analysis. In addition, the application of pedagogical lexicography standards in digital dictionaries is not yet optimal, so that the resulting understanding of Arabic tends to be surface-level. Therefore, the future development of Arabic digital dictionaries needs to integrate more comprehensive lexicography standards and the use of smart technology so that they can function optimally as Arabic language learning resources.

Based on the analysis of the 14 reviewed articles, seven main categories were identified that describe the trends in Arabic digital dictionary research. The most dominant category is the effectiveness of digital dictionaries in improving vocabulary mastery, mentioned in six articles. This finding indicates an agreement among researchers that digital dictionaries play a significant role in helping learners understand mufradāt more quickly and efficiently. This advantage is mainly related to the ease of access and speed of meaning search offered by digital dictionaries compared to printed dictionaries. However, the dominance of this finding also indicates that most studies still focus on the practical outcomes of vocabulary learning.

At the same time, the same number of articles (six articles) also highlight the weaknesses of digital dictionaries, particularly in the aspects of contextual meaning and sharaf analysis. This indicates a paradox in the use of digital dictionaries: although practically effective, digital dictionaries are not yet fully able to support an in-depth understanding of Arabic linguistics. The limited presentation of sentence context, word derivation, and grammatical structure has the potential to cause surface-level Arabic language learning. This finding indicates that the effectiveness of digital dictionaries remains partial and highly dependent on the quality of the linguistic features provided. The category of the importance of lexicographic principles appears in five articles, which affirm that an ideal digital dictionary should not only emphasize ease of use but must also fulfill pedagogical lexicography principles, such as precision of meaning, completeness of information, clarity of lemma structure, and educational function. This finding strengthens the argument that the development of Arabic digital dictionaries needs to be grounded in scholarly lexicography standards in order to function as a quality learning resource, not merely a translation aid.

Meanwhile, the categories of learning independence, the practicality of digital dictionaries, the existence of printed dictionaries, and the integration of advanced technology such as artificial intelligence (AI) are mentioned in only a small number of articles. The learning independence category shows that digital dictionaries can encourage independent learning, but this is not always followed by an improvement in deep linguistic understanding without pedagogical guidance. Findings regarding the existence of printed dictionaries affirm that although digital dictionaries are increasingly dominant, printed dictionaries still play an important role in learning Arabic lexicology and morphology and as scholarly heritage. Meanwhile, the category of AI integration and advanced technology indicates the future direction of digital dictionary development, although research on it remains limited.

Overall, the results of this discussion show that current research on Arabic digital dictionaries is still dominated by studies of practical effectiveness, while aspects of linguistic depth, lexicography standards, and smart-technology-based development have not been widely explored. Therefore, future research needs to be directed toward the development of Arabic digital dictionaries that integrate the advantages of technology

with pedagogical lexicography principles in order to comprehensively improve Arabic language competence.

Although most studies show that digital dictionaries are effective in improving vocabulary mastery, many studies also reveal their weaknesses in presenting context, sharaf, and linguistic depth. Therefore, further research is still needed to develop Arabic digital dictionaries based on pedagogical lexicography principles and smart technology so that they can support Arabic language learning more comprehensively.

Cross-Language Comparison and Conceptual Model

To enrich the perspective, the findings on Arabic digital dictionaries in this section are also compared qualitatively with the general characteristics of more established digital dictionaries in other languages, such as English and Mandarin digital dictionaries. This comparison is compiled based on a synthesis of findings from the reviewed articles as well as the general characteristics of popular digital dictionary applications, as summarized in the following table.

Table 2. Cross-Language Comparison and Conceptual Model

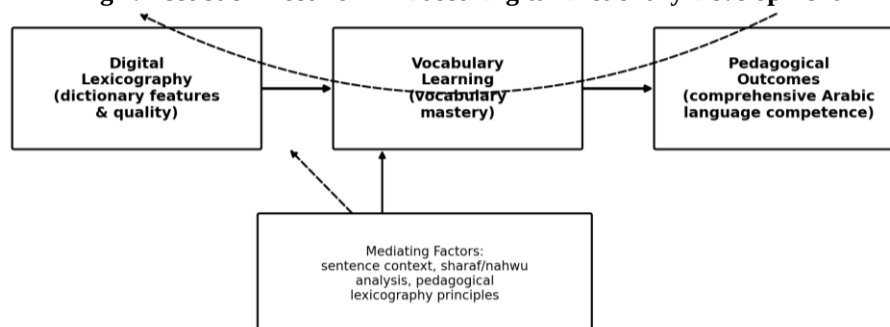
Aspect	Arabic Digital Dictionary	Digital Dictionaries of Other Languages (e.g., English, Mandarin)
Morphological analysis	Generally limited; rarely presents root words, wazan, or explicit sharaf analysis	English dictionaries present basic affixation analysis (e.g., Merriam-Webster); Mandarin dictionaries (e.g., Pleco) present character components and radicals
Sentence examples & context	Minimal; mostly oriented toward literal translation without usage examples	Generally complete, supported by language corpora (e.g., Oxford, Merriam-Webster, Pleco)
Pronunciation audio	Available in some applications, with limited dialect variation	Almost always available, often with accent/dialect variation
Artificial intelligence (AI) integration	Still limited and developing (e.g., simple automatic translation)	Relatively more mature, including OCR, handwriting recognition, and conversational assistants (e.g., Pleco, Google Dictionary)
Pedagogical lexicography standards	Generally not yet optimal; lemma microstructure and precision of meaning remain limited	Relatively more established, largely following learner lexicography standards (e.g., the COBUILD approach)

The comparison in the table above shows that Arabic digital dictionaries still lag behind in the aspects of morphological analysis, presentation of sentence context, and artificial intelligence integration compared to digital dictionaries of other languages that have more maturely adopted learner lexicography standards. This gap strengthens the argument that the future development of Arabic digital dictionaries needs to adopt pedagogical lexicography principles and smart technology that have already been applied in digital dictionaries of other languages.

Based on the synthesis of the findings above, the relationship between the quality of digital lexicography, the vocabulary learning process, and pedagogical outcomes can be depicted in the following conceptual model. This model affirms that the quality of digital lexicography (encompassing precision of meaning, sentence context, and sharaf/nahwu analysis) influences the effectiveness of vocabulary learning, which in turn determines pedagogical outcomes in the form of comprehensive Arabic language

competence. These pedagogical outcomes then provide feedback on the need for better digital dictionary development in the future.

Fig 1. Feedback Need for AI Based Digital Dictionary Development



CONCLUSION

Based on the results of the Systematic Literature Review of 14 articles, it can be concluded that Arabic digital dictionaries play an important role in Arabic language learning, particularly in improving vocabulary mastery and supporting learners' independent learning through practicality and ease of access. However, most studies also show that digital dictionaries still have limitations in the presentation of contextual meaning, sharaf analysis, and linguistic depth, so that the resulting understanding of Arabic tends to be surface-level. In addition, the application of pedagogical lexicography principles in digital dictionary development is not yet optimal, and research on the integration of smart technology, such as artificial intelligence, remains relatively limited. The cross-language comparison strengthens these findings, showing that Arabic digital dictionaries still lag behind digital dictionaries of other languages, such as English and Mandarin, particularly in the aspects of morphological analysis, presentation of sentence context, and artificial intelligence integration. The conceptual model generated from this study affirms that the quality of digital lexicography influences the effectiveness of vocabulary learning, which in turn determines pedagogical outcomes in the form of comprehensive Arabic language competence, mediated by factors such as sentence context, sharaf/nahwu analysis, and pedagogical lexicography principles. Therefore, the future development of Arabic digital dictionaries needs to be directed toward integrating pedagogical lexicography standards with the use of modern technology, as has already been applied in digital dictionaries of other languages, so that they can function optimally as comprehensive and sustainable Arabic language learning resources

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