Online Dictionaries' Applications and Associated Linguistic Topology Categorized to Support Users: Systematic Review

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Abstract

In the past, the only sources for linguists to learn from were printed linguistic books. Traditional books were found to be unattractive to read due to their formal design, sophisticated language, size, weight, inconvenience, and difficulty of storage. Online dictionaries are one of the most useful tools for learning and improving linguistics. They provide an effortless way to upgrade, maintain, preserve and store the data of users. All levels of both non-linguists and linguists can sustain and enhance their knowledge and proficiency from the facilitated applications more quickly and conveniently. The paper presents current tools and technologies available to users, and creates a discussion of and differentiate linguistics from language perception. Consequently, the article synthesized the employment of different online dictionaries and their features concerning the associated linguistics based on the analyzed topological categories which were explained more clearly and with greater comprehension. Web app architecture or web programming operations are dismissed in this article. Users can gain benefit to explore, learn, and cite the tools they need to succeed in personal, academic, and professional environments. It was also meant to establish and discover the useful and beneficial connections between linguistics and Internet technology and current web application as it pertains to all instructors and students, and general users alike.

1. Introduction

In an ever-changing era, required skills in science, technology, engineering, and math disciplines by integrating online resources can enhance people's ability. In addition, they can understand and solve some of the complex challenges of today and tomorrow and meet the demands of the dynamic and evolving workforce, scholars, and lifelong learning [1]. In recent years, many online resource environments support learners and/or any interested users in order to facilitate and enhance knowledge and practical skills. IGI Global Publisher has concluded the definitions of the terms from a diverse study that is often used interchangeably to online resources, yet the empirical meaning may be different.

Web resources are the platform where they contain the development of web applications, for example, web projects, HTML pages, JSP files, servlets, custom tag libraries, and archive files [2]. Web resources are an invaluable digital baseline to create the information and subject environment, education and self-education to meet personal and professional interests and needs [3]. Online resources, on the other side, mean archetypal data and education in nature, including web pages and documents, practical tools for online teaching and learning, materials, notes, timetables, notices, and so forth, for online reading, and any kind of support software available in an online platform which is accessible via the Internet and the World Wide Web [4]. However, critical internet resources refer to the elements of Internet infrastructure to critically secure and stabilize functioning root servers, backbone structures, domain name systems, addresses, and protocols [5].

2. Web Applications as Online Resources

Web application, or web app, is an application program which is designed for a wide variety of uses utilized by

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everyone [6]. The commonly used web apps cover GSuite, Office365, ZOHO suite, Salesforce, HubSpot, FreshBooks, Dropbox, browsers [7], dynamic social website, real time weather forecast websites, live music and movies on websites, online games, online program and tools, webmail, online calculators, or e-commerce shops [6]. Web applications as online resources were categorized into three categories, by Morrison [8], including technical, academic, and study skills. These can be discussed as follows.
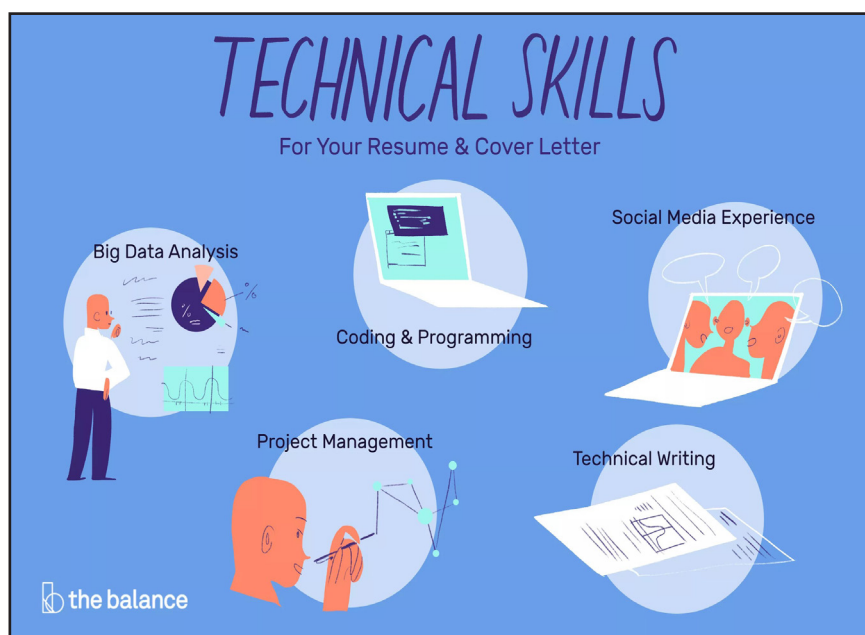
2.1 Technical Skills

Technical skills, or professional skills, require knowledge and expertise to achieve sophisticated actions, tasks and processes, practically relating to work fields of mechanics, information technology, mathematics and science. The skills also include a diverse group of other business enterprises for financial, marketing and technical analysis, as shown in Figure 1. Technical skills require specific education or training in areas involving scientific, technological, engineering, mathematical capabilities, and computational ones for employment [9]. Besides academic institutions, or national government training divisions like local training (offline training) [10] and online training (e-training) [11], several online short courses and training resources are available either or both on national and international websites.

Example resource sites provide instruction for users in straightforward web skills, such as e-file uploadings, web surfing and navigating techniques [12], online photo editor, Netacad, w3schools, programmr, datacamp, ide.geeksforgeeks, navigating learning management system (LMS) platform entries, such as Blackboard, Haiku, Canvas, Desire2Learn, and Moodle [8], bookmarking sites, using applications, downloading needed plug-ins or software.

2.2 Academic Skills

Academic skills are essential for successful tertiary study [14]. The skills are made up of core skills, as shown in Table 1, such as academic writing, presentation skills and referencing, which underpin those behavioural skills, such as critical thinking and reflective practice. In addition, academic skills consist of the following vital skills [14]-[15]:

Academic skill resources can be found from university websites, such as the Academic Skills Centre from Edith Cowan University's website [16], and virtual schools and web services (e.g., Khan Academy, Coursera, Udemy, Alison, Udacity, Skilllane, Study.com). The latter ones offer free and commercial services including writing help of any kind, practicing grammar, literacy, developing math, statistics, chemistry, biology, history and language arts skills.

Figure 1. *Technical skills for IT employment [13].*

Table 1. Core academic skills.

Title	Topics Covered
Academic language	Terminology and acronyms, the language of academic discourse
Information technology	Word-processing, presentation software, internet searches, retrieving and managing information (e.g. note-taking, research skills, library skills)
Critically academic note-taking	Pre-reading selection tactics, text marking and summarising, critique and responding to text
Graphic and statistical forms	Understanding and using graphic forms such as graphs, pie-charts, charts, basic statistical terms
Academic texts production	Planning, structuring and developing written assignments
Independent learning skills	Organising study periods, planning for assignments, revision and exams (e.g. pressure handling, strategies' revision), tasks managing and problems solving (e.g. time management)
Interpersonal skills	Pair/group/collaborative projects, teamwork etc
Communicating effectively	Conference, symposium, seminar, presentation
Writing skills	Essay writing, report writing, summaries, etc
Numeracy and mathematics	Statistical analysis, data analysis, math calculatio
Research skills	Research methodology, literature studies

2.3 Study Skills

Study skills cover a broad range of tactics and strategies so that the learners can effectively learn, organize, and recall new information [17].

Study skills comprise "an integrated repertoire of tactics and strategies, which facilitates acquisition, organization, retention, and application of new information", as defined by Ball [17]. Generally, study skills, in other words, learning skills are "the tasks involved in learning, including time management, note-taking, reading effectively, study skills, and writing tests" [18]. Other definitions of study skills are shown below.

Pepe [19] reviewed and summarized the types of study skills that covered the regular study, listening to the lectures, noting, efficient written explanation, active participation in the lesson, doing homework, preparation for the exam and attending the exams. Resources for study skills are also

Figure 2. Study Skills Resources (Student Success Centre) from Confederation College [20].

available via school websites which provide information or guidelines about how to improve learning or studying skills.

Figure 2 illustrates the types of study skills that can be offered to the student differently depending on the institution. Some of these skills provided are presentations, note-taking, time management, working in groups, writing essays, flashcards, and dictionaries, thesaurus and grammar. Additionally, several free online resources provide information about study and skill development for interested persons. Some other examples of study skill resources can be discussed as follows.

Study Skills Online Resources from Sagepube.com's websites [19] provides online textbook, handouts, short and long articles, weblinks and additional materials, audios and videos, and document templates to support critical thinking, writing skills, mindfulness, linguistic and language usage for students and general learners. Center for Research on Learning and Teaching from University of Michigan's website [21] focuses on teaching techniques and evaluation strategies as well as student writing guides and learning portfolios and e-portfolios. Study Skills for Students from Educationcorner. com's website [22] contains much information about proven tips and techniques for studying smarter, test taking guides, and study skills resources by subjects. The site is suitable for

students from the early childhood level to higher education. The special education topics and articles are also covered. Also, HowToStudy.org's website [23] and Study Skill Resources from Lehigh University's website [24] show similar contents about the personal study skills and learning management articles and tips.

It can be summed up that technical or professional skills involve a career competency, technology usage, and technical terms used for professions. Academic skills necessitate academic communication efficiency, critical thinking, and science, technology, engineering, and mathematics knowledge (STEM). Study skills require life-long strategic learning and management tactics. It can be seen that each of the above groups has its relevant websites which provide useful information and knowledge that learners could gain after completion or achieving the learning outcomes. Nonetheless, all the skills require information technology and linguistic and language skills to comprehend in the descent era.

3. Linguistics Versus Language Towards Linguistic and Dictionary Skills Advantages

The distinction of linguistics from language is the concept of a branch of study that deals with languages versus sound expression of thought employing articulate sounds [25]. Language refers to a mode of expression of thought from articulate sounds of spoken or written words used by people of a country, area or social group in a specific language [26] such as English, Thai, Malay, or German languages. Language can be studied from a physical or biological standpoint, as well as from social perspectives. Language is a unique and organic communication system which only humans possess, and it grows and changes all the time. Contrastively, linguistics is the scientific study of the way language is used daily. It is mainly concerned with the development of language theories and the creation of concepts for the description of natural languages in general. Conversely, linguistics is a descriptive discipline in the field of science of language as opposed to the study of particular languages [27]. It is the analysis of the

origins of language, and the nature, structure, function and usage of human language [28]. Wang [27] defined linguistics by saying that linguistics lies at the root of what and how language learners can learn. Linguistics describes the process of languages from construction, work, adaptation and transformation, termination and perhaps regeneration. Since this article focuses on the linguistic theory that can be integrated with online dictionary applications, the deep understanding of the language will be set aside.
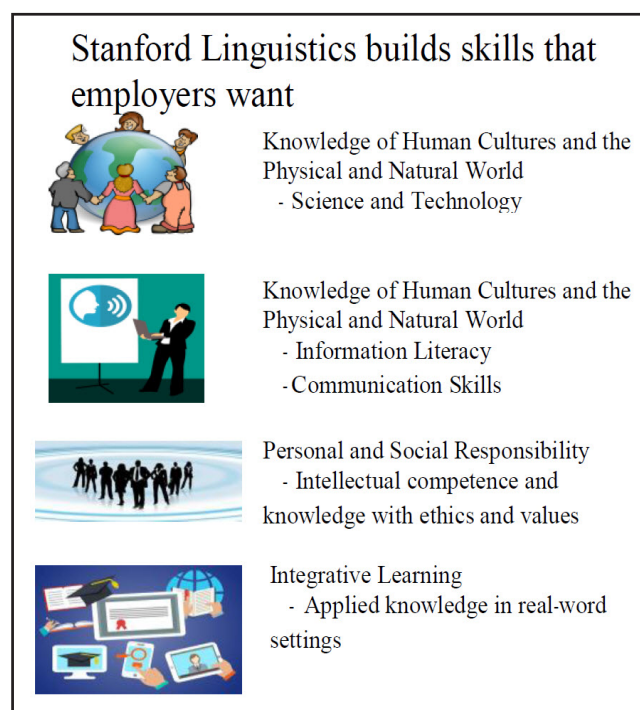
Figure 3. Stanford Linguistics builds skills that employers want (adapted from Stanford University)[29].

Stanford Linguistics builds skills that employers want based on linguistic knowledge [29]. This is illustrated in Figure 3. The advantages of linguistics at work were partly selected for IT emphasis. Firstly, linguistic theory studies a diversity of humans and culture and lies in computational linguistic study. The theory emphasizes information packages and symbolic delivery. Secondly, it improves information literacy and communication skills through the use of technological tools and a large amount of data in search of crucial pieces of evidence where information is out there somewhere on the Internet. Thirdly, linguistics can develop teamwork with native speakers of various languages to

Table 2. Linguistic levels classified by linguists.

Linguistic Typology/ Categories [35]-[36]	Hickey [35]	Oxford University Press [37]	Liberman [38]	Kracht [39]	Capuz [36]
Phonetics (all human speech sounds)	✓		✓		
Phonology (classified sounds/ sound system)	✓	✓	✓	✓	✓
Morphology (word structures/forms)	✓	✓	✓	✓	✓
Lexicology (study of word/ word origin/etymology)	✓				✓
Syntax (word orders/ sentences/ clauses/ sentence structure)	✓	✓	✓	✓	
Semantics (the meaning of various kinds/ study of meaning)	✓		✓	✓	✓
Pragmatics (sound patterns/ language uses/ utterances communicate meaning/ social expression/technical terms)	✓		✓		✓
Orthography (writing system/ spelling)					✓
Phraseology (idiom)					✓

develop and handle complex experiments or computational systems. Lastly, linguistics is information workers which integrate with independent creative and advanced studies to develop complex analytical problems and effective techniques for problem-solving using technology at hand.

The research of Campoy-Cubillo [30] reviewed several previous studies and can be concluded that dictionary skills act as parts of professional reference skills for work, academic skills for teachers and students, as well as life-long language learning skills. Dictionary skills together with knowledge in dictionary typology and dictionary micro- and macrostructure can affect the quality of consultation in professional careers, and especially for teachers and students. Dictionary skills and other language skills together with dictionary usage aids progress in self-teaching of different language skills [30].

As time goes by, the use of electronic tools in English linguistics and/or language practices has attracted the attention of interested users. However, electronic reference applications such as spell checkers, dictionaries, encyclopedias, and translation programs can be used to represent a traditional print-based copy in order to explore information and communication technologies in foreign languages for teaching and learning [31]. Ever since the emergence of computer and Internet technology, the use of web and electronic dictionaries as learning tools, or their integration in multimedia learning platforms, and the analyses of computer-mediated dictionaries and multimodality in dictionaries gain more advantages to dictionary users to create new dictionary skills research as well as a new user profile in relation to linguistics. Computer-mediated lexicography brings new perspectives into the field of dictionary skills to support other important skills, as mentioned above [30].

4. Linguistic Classifications and Typology

The field of linguistics is broad and diverse to varying degrees that the forms of language can be understood separate from their use [32]. Much research on linguistic relationships has been carried out. Individual areas of linguistics may be categorized by many different criteria or combinations of criteria. Lyons [33] classified the field of linguistics into four groups which include historical versus non-historical, synchronic versus diachronic, theoretical versus applied, and micro linguistics versus macro linguistics. Based on the Dewey Decimal System (DCS) in the University of Johannesburg Library [34], linguistics has also been classified into the following dichotomies: linguistics, notations, etymology, polyglot dictionaries, phonology, structural systems (grammar), dialectology and paleography, usage (applied linguistics), and verbal language. Furthermore, linguistics can also be divided into some other areas including sociolinguistics, language acquisition, language and the brain,

contrastive linguistics, language change, and linguistic theory [35].

Linguistics underlies the structure of language and the means of common verbal communication. Many linguists have categorized linguistic levels in many aspects, as shown in Table 2. It can be seen that all linguists have categorized phonology, morphology, and semantics in all linguistic categories, followed by syntax and pragmatics. All these linguistic terminologies can be further discussed below.

4.1 Phonetics

Phonetics is the study of the classification of sounds in human speech. It can also be divided into the study of the production, transmission, and perception of those speech sounds. These categories are formally known as articulatory, auditory, and acoustic studies, respectively [35], [40]. Phonetics is involved in brain processing when people speak and listen to language [41]. In other words, phonetics deals with all sounds in human speech and the analysis of their production. It is also the study of vowels and consonants and the types of phonation and tone [42]. Examples of phonetics are voice commands over the smartphones, or text readers by human voice to operate the electronic devices [37].

4.2 Phonology

Phonology is the pattern of speech sound of human cognition. The study of phonology also discovers which sounds can be combined into words [37]. The inclusion of phonetics is sometimes considered a part of this field by some linguists [43]. Phonology determines which phonetic sounds are significant and studies and analyzes them. It also explains how a native speaker of a language would interpret these sounds. Lorenz [37], described phonology that:

"Taking the German word (reich) as an example, if one substitutes the sound represented by (ch) with (f), it becomes a different word. If it is substituted with the consonant sound heard in (ach), on the other hand, it sounds like a Swiss accent, but it is essentially the same word (p.1)."

Some terms that are related to phonology include homonyms (different spelling, and same pronunciation, but

different meaning) [44] and homophones (same sound), heteronyms (different pronunciation, and different meaning, but same spelling), homographs (same writing), and heterographs (different writing) [45].

4.3 Morphology

Morphology is the branch of grammar which studies how words relate to other words of the same language. It is the structure or form of words [40]. The basic unit is designated as a morpheme. It is the smallest unit in a language that has meaning. Morphology interacts in significant ways with both phonology (bringing sounds together can cause them to change) and syntax, which needs to pay attention to the form of a word when it combines with other words.

Furthermore, morphology is inflectional, concerned with the endings put on words, and derivational, involves the formation of new words, when an affix is added to create a new word or a new form of a word [35], e.g., happy + -ness. An inflectional morphine is when an affix is added to the basic word form to make a new word. For instance, 'teacher' can have an –s added, which makes the new word 'teachers'. It indicates that there is more than one teacher, but it does not create a new lexeme or word form, nor change the grammatical category of the word. Inflectional morphemes also use affixes to give grammatical information for gender, tense, and case as well.

4.4 Lexicology

Lexicology can be confused with lexicography. Many research studies explain how these two words differ. Ginzburg et al. [46] defined lexicology as the science of the word which is composed of word or phrase, and learning or department of knowledge. On the other hand, Klein [47] defined lexicology as the internal structure of the lexicon [35] of a language, including its historical development, social stratification, quantitative composition, or encoded thematic area. It is a study of systematic description of vocabulary in respect to its origin, development and current use. The vocabulary examination involves words and their meanings and variable word-groups [46]. Lexicology is associated with lexicography,

which is the writing and making of dictionaries [48]. Thus, an example of lexicography is the compilation of dictionaries [35], [47].

4.5 Syntax

Syntax is a sentence consisting of words, which are arranged into groups of varying size, called constituent [39]. This part of linguistic study is concerned with the characteristics of sentences. It focuses on the grammatical study [44] of noun phrases and verb phrases [35], clauses and sentences, word order, and part of speech which are constructed and combined in particular languages. Some examples are 'the dog sees the cat eat the mouse', 'this villa costs a fortune', and 'this villa costs much' [39].

4.6 Semantics

Semantics is the study of sentences of a language and meanings with the logic of reasoning [39]. Due to the sophistication of meaning interpretation in language, different theories can be used within semantics as discussed below [49].

4.6.1 Formal semantics refers to techniques from math, philosophy, logic to analyze reality, truth and possibility with if clause sentences and questions.

4.6.2 Lexical semantics deconstruct words and phrases within a context to understand the meaning of individual nouns, verbs, adjectives, prefixes, root words, suffixes, or longer phrases or idioms.

4.6.3 Conceptual semantics deals with meanings and explanatory form of a word describing human expression to a conversation on connotation (imaginative implication) and denotation (literally precise or sign language implication).

Examples [52] are illustrated in Table 3. Semantics focuses on the speaker's language competence in communicating meaningful and comprehensive utterances [41]. Semantics is also concerned with the expression of phrases, grammatical forms, synonymy (sameness of meaning), antonymy (difference in meaning), and hyponymy (hierarchical words of the similar group) [35].

Table 3. *Semantic meanings and examples.*

Word	Meaning
Crash	It can mean an auto accident, a drop in the Stock Market, attending a party without invitation, ocean waves hitting shore, or sound of cymbals struck
Human	A human can be referred to as a male, female, child, person, adult, baby, bachelor, father or mother
Young	It can allude to a colt, filly, baby, puppy, or kitten
Move	The verb 'move' can mean change place, push, pull or carry, or stir emotion
Blue	Blue can refer to colour or sad/ depressed feeling
Blue	Fire as burning or termination from a job

4.7 Pragmatics

Pragmatics is concerned with the interpretation of linguistic meaning in context. It is similar to semantics. However, pragmatics is about a relationship between a speaker and listener. This relationship allows assumptions to be made about the intended message from background knowledge about the speaker and the topic of discourse [44] and the way the context contributes to its meaning. It can also be the way the speaker and the writer communicate with each other [38]. There are two intents involved in such an act: informative intent or the sentence meaning and communicative intent or the speaker meaning [50]. Examples [51] are shown below.

"Jenny got an A on the test", direct assertion speech.

"Did Jenny get an A on the test?", direct question.

"Jenny, get an A on the test!", direct order and request speech.

"Do you know if Jenny got an A on the test?", indirect question speech.

"I'd like to know if Jenny got an A on the test.", indirect order speech.

"I wonder whether Jenny got an A on the test.", indirect request speech.

"I assert that Jenny got an A on the test.", performative statement.

Having this knowledge, the questioner can come to the correct conclusion the speaker intended. Pragmatics can be considered as conversation analysis since it seeks to understand a speech act in an actual speech situation.

4.8 Orthography

Orthography is an implementation of a writing system technology in a specific language [52]. It is associated with phonological (a speech sound) and morphological (word) structure of the language [53]. Examples [54] can be illustrated in Table 4.

Table 4. American spelling and English spelling.

American	English	American	English
behavior	behaviour	jewelry	jewellery
counselor	counsellor	wagon	waggon
ax	axe	catalog	catalogue
annex	annexe	fiber	fibre
toward	towards	organize	organise

It shows that orthography differentiates between American and (British) English spellings. Further, orthography does not necessarily follow the same rule applied to all words. In some cases, similar word forms can have different speech sounds, such as 'heal' and 'health' [53]. Another example is 'ear' which can be pronounced differently as bear, tear, near and fear.

4.9 Phraseology

Phraseology is the study of phrases or multi-word units. It is a subfield of lexicology and often deals with word combinations rather than a single word [55]. It can be found quite often for phraseology to be associated with collocations (typically verbs or adjectives plus noun collocations) or with pragmatic and communicative phrases. Table 5 illustrates the phraseological patterns and examples [1]. It consists of several words and tends to be idiomatic [36]. To specify, a phrase or phraseologism, includes the form of a word, together with one or more additional word items, so that these units collectively function together as one semantic thought in a clause or sentence.

Table 5. Phraseological patterns and examples.

Patterns	Examples
Verb + noun	set the alarm, launch a missile
Adjective + noun	strong tea, chronic alcoholic
Adverb + adjective	deeply absorbed, sound asleep
Verb + adverb	affect deeply, anchor firmly

5. Online Dictionaries Concepts and Types

A dictionary is an invaluable tool for anyone. Online dictionaries facilitate users with ease, convenience, and free of charge. Online dictionaries are generally designed with three common interactive interfaces: monolingual, bilingual, and multilingual dictionaries [56]

5.1 Monolingual dictionaries explain the meaning and definitions of a word in the same language that one is learning [57], such as English to English, Thai to Thai. The obvious interactive design is where the search box shows the search text box for a keyword and a search button. Some monolingual online dictionaries include Cambridge, Merriam-Webster, Dictionary.com, Macmillan Dictionary, and Oxford dictionaries.

5.2 Bilingual dictionaries, on the opposite, show words in two languages. Each language is grouped alphabetically with translations into the other language [58]. The search system provides an additional box or selection menu for users to switch the keyword translation from one word to another. The online dictionary examples are Longman and Cambridge dictionaries.

5.3 Multilingual dictionaries, furthermore, offer more than two language translations for users to select from. The extra language selection menu for users is provided to translate from one word to another. These examples are Wiktionary. org, Google dictionary and Google Translate, Webster-Dictionary.org.

6. Online Dictionaries Lists Associated to Linguistics

In this section, the paper discusses linguistic levels, which can be matched with the online web app' features. The benefit of this approach is that it allows related terms to be grouped and categorized in ways that the applications offer. The purpose of this article is to provide an alternative way to learn linguistics and to find the correct terms and definitions whether it is for searching or to describe an object which can enhance the skills mentioned above.
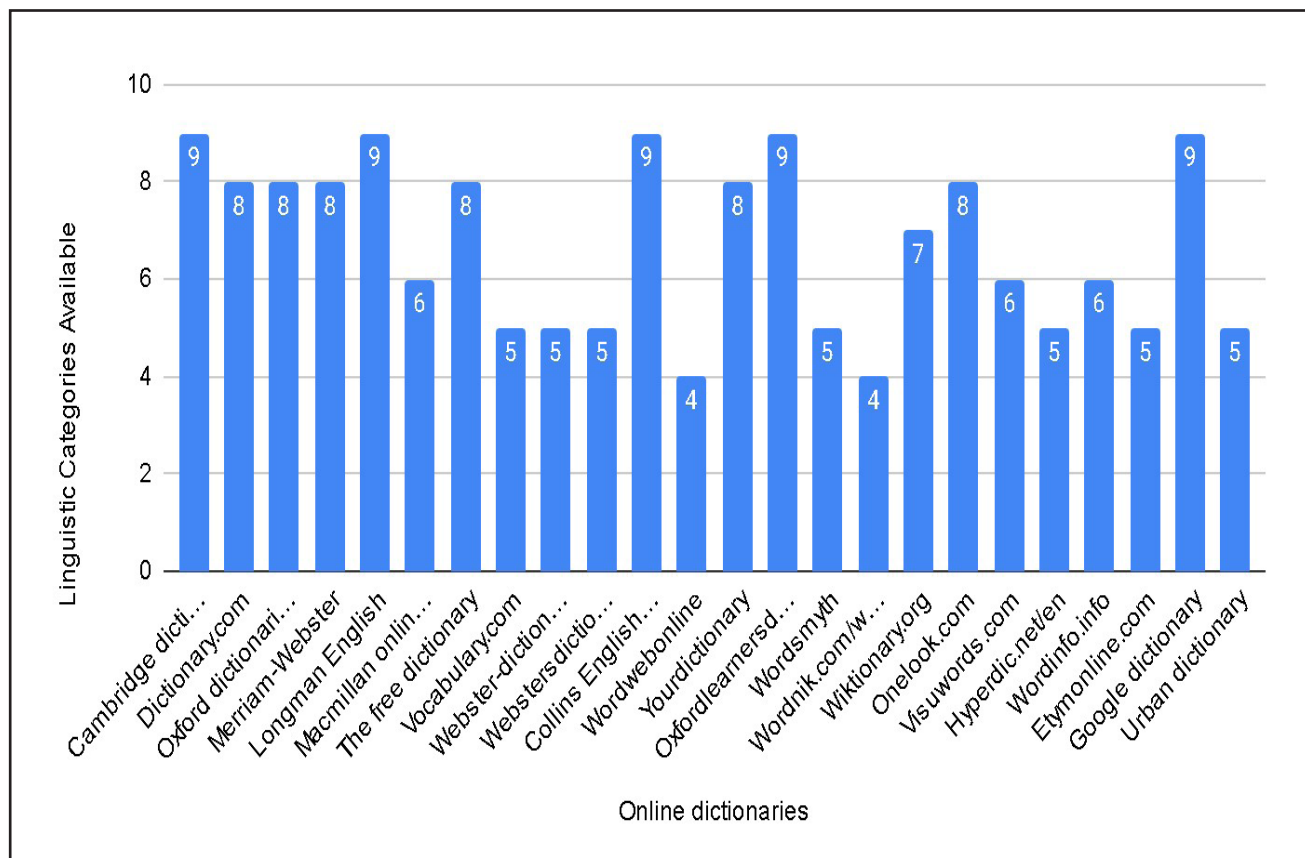
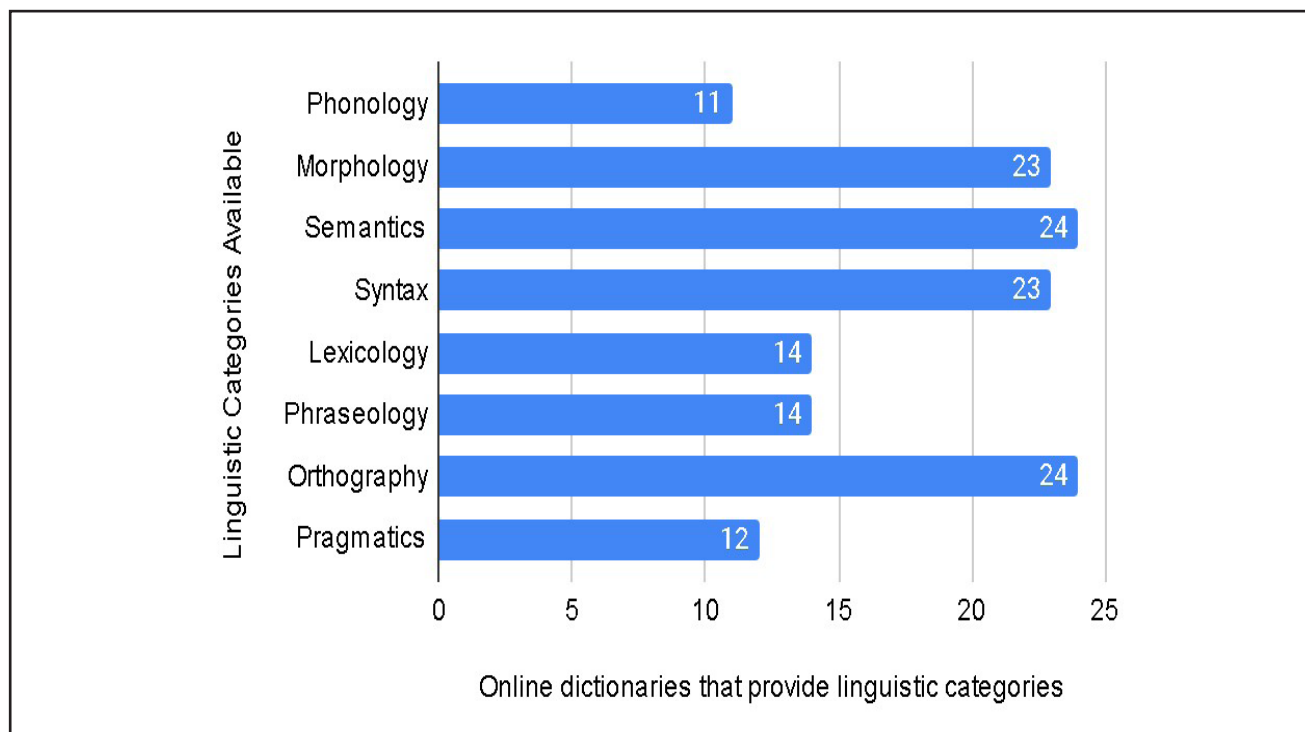*Figure 4.* List of 24 online dictionaries associated with the 9 categories of linguistics.

Figure 5. Linguistic categories associated with 24 online dictionaries.

Figure 4 and 5 show 24 online dictionaries in which their features are associated with linguistic topological levels. One can see in Figure 4 that 5 websites have all 9 types of linguistic terms, while most websites contain only 5 categories. Figure 5 shows that semantics and orthography were all available among the 24 websites, followed by morphology and syntax, while phonology and pragmatics were least and second least available on the online dictionaries. The online dictionaries in Figure 4 refer to many respected and established dictionary companies (e.g. Webster and Oxford) as well as dictionaries that have been created online (e.g. Google). The former were adapted and upgraded from their previous versions and updated to include many useful technological features which were previously unavailable in older, standard dictionaries. These websites can act as linguistic helpers for users who need to understand the meaning and learn more about the word for different purposes. The architecture and system operating under these resources need upgrading as well as the newer features and vocabulary updates, the systematic review paper of the 24 websites may be obsolete from time to time as technology advances. However, the concept, knowledge and skills learned from online dictionaries are still valid and are continually updated.

In fact, there are many types of dictionaries to support users, depending mainly on which lexical units are included, and which of their properties such as sound, spelling, grammatical features, meaning, etymology, and so on [47]. Many electronic dictionaries are equipped with text-to-speech and speech-to-text capabilities, interactive vocabulary games, vocabulary journals, data transportation and internet access. Some electronic dictionaries are available on smartphones, tablets, and computers, both online and offline. Therefore, the number of vocabulary items in electronic dictionaries is more plentiful than dictionaries in print. These are not limited to only the word items. Interactive learning functions such as vocabulary games, speech features, and reference books can be included in the electronic versions.

7. Conclusions

The word linguistics may be unusual for some people, and yet they may inadvertently utilize the material which has linguistics printed or recorded in them. In this modern technological age, linguistic resources are readily available online. Since technology continually grows to facilitate linguistics, in this paper the researchers first defined the term online versus web resources, and categorized online resource skills. Second, the authors explained the use of dictionary skills toward online resources skills. Third, previous studies were reviewed on linguistic types, purposes, and using online dictionaries in enhancing skills adequately for linguistic purposes. There are many web applications for linguistic users to access and gain more information. This article reviewed and introduced linguistic levels that can be associated with the web dictionaries' features. The literature review indicated that the effective use of online resources, such as online dictionaries, have been used to help and improve linguistic literacy and communication for work, study, and long term personal development. Choosing the right application can enhance the capacity of users. However, relying on only one source can limit users from learning and determining the best outcome. It is worthwhile to improve oneself by utilizing many sources and tools, and use one's judgment for the best results.

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