Digital Resources and Electronic Resources: Conceptual Analysis and Terminology Standardization Discussion Postprint

Authors: Xu Qingmei, Tao Rui, Ye Jiyuan

Date: 2023-04-01T00:00:00+00:00

Abstract

[Purpose/Significance] This study examines the evolution of the terminology of "digital resources" and "electronic resources," investigates the current research and usage of these two terms in both academic and professional communities, clarifies their conceptual relationship, and proposes recommendations for their standardized usage. [Methods/Process] Employing research methods including conceptual analysis, comparative analysis, and web-based investigation, this paper surveys and comparatively analyzes domestic and international literature concerning the concepts and relationship between the two terms, summarizing three primary viewpoints. A bibliometric analysis of the publication chronology of relevant literature using both terms is conducted, supplemented by statistical analysis of the usage of these terms on official websites of various types of libraries domestically and internationally, thereby revealing usage patterns and evolutionary characteristics of the two terms in both academic and professional spheres. [Results/Conclusion] Analysis of the research findings indicates that digital resources and electronic resources constitute a pair of "old-new terms," representing different terminological expressions of the same concept, with distinct historical imprints and technological application differences. Finally, reference suggestions are proposed for the standardized usage of these two terms in both theoretical and practical domains.

Full Text

Digital Resources and Electronic Resources: Conceptual Discrimination and Terminology Standardization

Xu Qingmei, Tao Rui, Ye Jiyuan
School of Information Management, Nanjing University, Nanjing 210023

Abstract:
[**Purpose/Significance**] By tracing the terminological evolution of "digital resources" and "electronic resources," investigating current academic and practical usage of these terms, clarifying their conceptual relationship, and proposing recommendations for their standardized use. [**Method/Process**] Through conceptual analysis, comparative analysis, and network research methods, this study investigates and comparatively analyzes domestic and foreign literature concerning the concepts and relationships of these terms, summarizing three main viewpoints. A quantitative analysis of publication years of relevant literature using both terms was conducted, along with statistical analysis of their usage on library websites of different types both domestically and internationally, to understand usage patterns and changing characteristics in academic and practical circles. [**Result/Conclusion**] Analysis of research findings indicates that digital resources and electronic resources constitute a pair of "old and new terms" representing different terminological expressions of the same concept, with obvious historical traces and technological application differences. Finally, reference suggestions are proposed for the standardized use of these two terms in theoretical and practical domains.

Keywords: electronic resources; digital resources; terminology standardization; information resource construction
Classification Number: G251
DOI: 10.13266/j.issn.0252-3116.2021.18.001

Since the beginning of the 21st century, rapid development of information technology has made information resources a hot topic across numerous fields. With the advancement of the digital wave, the concept of "digital resources" has emerged and permeated all aspects of various domains, becoming a research focus in many disciplines such as computer science, information science, and education. This term has also appeared in relevant regulations and government documents across industries. However, the more traditional concept of "electronic resources" (including electronic publications) has not faded from view and continues to be used in both academic and practical circles. With temporal development, information resource types have become more diversified, and the relationships between various terms have grown increasingly complex, inevitably affecting relevant basic theoretical research and practical operations. The question of whether "electronic resources" and "digital resources" refer to the same concept or to two distinct concepts—and if the same, which term is normative; if different, what their relationship is (subordinate, parallel, or intersecting)—requires in-depth investigation.

Currently, few scholars in academia have conducted specialized and in-depth theoretical discussions on this pair of terms, mostly using them as the same concept without detailed explanation. This paper primarily examines these two terms from historical and technological perspectives, employing historical research, conceptual analysis, comparative research, and network survey methods. The focus is on understanding current research and usage status in academia and

library practice, summarizing their relationships, and proposing standardized usage recommendations based on actual conditions to promote the development of information resource construction theory and practice.

This research is supported by the National Social Science Fund Major Project "Research on the Reconstruction of China's Document Information Resource Guarantee System in the New Era" (Project No.: 19ZDA346) and the Nanjing University Library Highlight Project "Research on Quality Evaluation of Chinese University Libraries."

---

2 Evolution of the Terms "Electronic Resources" and "Digital Resources"

2.1 Origins and Early Development

Tracing the origins of "electronic resources" requires examining its related concepts. The term "Electronic Resources" (or abbreviated as E-resources) originated relatively early abroad, traceable to a 1950 article by R. Coiler titled *Periodical Literature for Electronic Engineers*, which first mentioned "electronic literature" and discussed how electronic and communication engineers could retrieve and publish articles using electronic literature [1]. However, "electronic literature" did not gain widespread recognition at the time. Not until the 1970s did terms like Electronic Documentation, Electronic Publication, and Electronic Journal formally enter academic research scope. In 1978, C. Evans formally used "electronic-resources" in a title, exploring energy conservation strategies using electronic resources [2]. In 1985, a paper titled *Electronic Resource Sharing Changes Interloan Patterns* marked the widespread adoption of "electronic resources" in foreign library and information science [3].

In China, research on electronic resources started later. In 1982, Zhang Xiaolin published an article mentioning that electronic publications were "literature materials stored in computers or secondary storage devices in digital code form, transmitted and displayed through computer telecommunications networks and terminals, also known as computer-readable literature materials," thus formally introducing "electronic publications" into Chinese academia. In 1986, Chen Ying et al. first introduced the concept of "electronic resources" in a translated work by Lancaster, primarily referring to online resources. However, for the next decade, Chinese academia still mainly used and researched "electronic publications." The formal use of "electronic resources" in Chinese academia began with the concept of the electronic library. In 1995, Liu Zhengzhi formally mentioned "electronic resources" in his article *Electronic Libraries and Their Construction*, using it to refer to electronic books, magnetically recorded books, etc. [4]. Since then, Chinese academia gradually began using and discussing the concept of "electronic resources."

Unlike electronic resources, which were initially represented by several similar

concepts, "digital resources" began attracting academic attention with the emergence of digitization, though its formal use started slightly later, originating in the computer field. In 1980, D. Thompson et al. formally used "digital resource" in *Dynamic Network for Digital Resource Allocation*, describing from a technical perspective the generation and formation of digital resources in dynamic network interactive environments [5]. However, during the 1980s and 1990s, the term rarely appeared in academia, only gaining widespread use after the 1990s. In China, the term was first mentioned in a 1998 translated article *Protection Work in the Digital Domain* by Jia Guiren [6], primarily referring to digitized forms of existing information. The following year, Xu Suiwen formally discussed digital resources in *Random Notes IV: Creation of Digital Resources—SGML and Metadata* [7], though at this time digital resources still mainly took the form of digitized collection resources. Thereafter, "digital resources" began to be frequently used in Chinese academia.

2.2 Definitions from Authoritative Sources

Regarding definitions of electronic and digital resources, literature such as professional dictionaries and institutional guidelines that simultaneously define both terms is extremely rare. The *Dictionary of Library and Information Science* [8] mentions both definitions: electronic resources are "resources that store text, images, sound, animation, and programs in various forms of information storage on non-print media such as optical and magnetic media through data or computer coding, accessible through computers and other external equipment, including software, website resources, databases, e-books, and e-journals," while digital resources refer to "resources (data or programs) encoded for computer device operation." However, these definitions hardly clarify the relationship between the two. Although listed as separate entries suggesting different concepts, their definitions reveal numerous connections, such as highly consistent carrier forms and access methods.

Other professional dictionaries or guidelines only include one term or its predecessor. For instance, Zhou Wenjun's *Dictionary of Library and Information Science* [9] includes neither electronic nor digital resources, only electronic publications. The *English-Chinese Dictionary of Information Technology* [10] includes only digital resources, defined as "all information recorded in text, images, graphics, sound, and other forms using modern digital technology and means." China's Academic Library Digital Resource Procurement Alliance defines electronic resources as "commonly referring to digital information resources, i.e., all information resources produced and distributed in digital form, including text, images, sound, etc., presented through media such as hard disks, magnetic tapes, and CDs, as well as network forms" [11]. IFLA defines electronic resources as "materials that require computer access, whether through personal computers, mainframes, or handheld mobile devices, accessible remotely via the internet or locally" [12]. These definitions lack uniformity, emphasizing similar carrier forms and access methods but leaving their relationship (subordinate,

equivalent, or intersecting) unclear.

---

3 Literature Review

3.1 Data Sources and Methodology

Data sources for this section primarily include CNKI, Duxiu, Web of Science, Scopus, and ScienceDirect. Search terms included "electronic resource," "digital resource," "electronic resource," "e-resource," and "digital resource*." Literature types covered journal articles and books, with CSSCI journals selected for Chinese articles. The search period ended in December 2020.

Initial searches yielded 2,408 Chinese documents and 1,049 foreign documents (totaling 3,457). After screening to remove conference announcements, call for papers, newspapers, and irrelevant literature, 3,054 documents remained. These were randomly numbered using Excel, and 170 documents were selected for investigation. After reading and analyzing these, 49 documents where the author's stance on the two terms could not be determined were excluded, leaving 122 sample documents (100 Chinese, 22 foreign) for analysis.

Based on these documents, the relationship between the two terms can be summarized into three categories: the "digital resources greater than electronic resources" view (where digital resources is considered a broader concept), the "electronic resources greater than digital resources" view, and the "equivalence" view. The number and proportion of documents for each viewpoint are shown in Figure 1 [Figure 1: see original paper].

3.2 Three Main Viewpoints

3.2.1 Digital Resources Greater than Electronic Resources

As shown in Figure 1, 7 documents (5.7% of the sample) hold this view. Some scholars note that while digital resources has broad extensions, within the scope of digital library collection construction it (narrowly defined) primarily refers to electronic resources or electronic publications [13-14]. Others directly state that digital information resources (also called digital resources) narrowly refer to electronic (information) resources, not limiting them to the library domain [15], but still expressing the view that digital resources has broader extension. Some scholars approach from specific concepts, stating that digital resources refer to information resources processed digitally, accessible through computer systems or communication networks, narrowly also called electronic resources, i.e., all information resources produced and distributed in digital form [16]. Additionally, some scholars indirectly reveal this stance. For example, Zeng Jianxun proposed that in the process of digital resource construction, information resource institutions represented by libraries have increased the acquisition quantity and funding of electronic resources while reducing procurement of paper-based resources, where electronic resources mainly refer to electronic versions collected

by libraries [17]. This indicates that in the library domain, digital resources primarily refer to electronic resources—that is, digital resources is greater than electronic resources. L. Patrick et al., when investigating electronic resource management (ERM) trends in Hong Kong university libraries, first discussed the impact of electronic resources on user access and expectations, then proposed inherent challenges of digital resources, noting that libraries possess other digital collections besides electronic resources [18]. Thus, L. Patrick et al. treat digital resources as the broader concept while also narrowly limiting electronic resources to the library domain.

3.2.2 Electronic Resources Greater than Digital Resources

Fewer scholars support the view that electronic resources is greater than digital resources. As shown in Figure 1, only 2 documents (1.6%) in the sample hold this view. These scholars also distinguish the relationship from broad and narrow concept perspectives, arguing that narrowly defined electronic resources are also called digital resources, and that electronic resources purchased by libraries are digital resources, referring to the sum of all information resources produced, stored, and distributed in digital form [19]. Some scholars approach from concept extension, arguing that electronic resources have a very broad scope, narrowly including mainly commercial formal publications such as databases, e-journals, and e-books. These electronic resources are digital resources or academic digital resources, and electronic resources purchased by libraries basically belong to this level of resources [20]. Through comparison, from the library perspective, this view is completely opposite to the "digital resources greater than electronic resources" view above, showing that academia has differences on their subordinate relationship.

3.2.3 Equivalence of Electronic and Digital Resources

According to Figure 1, the view that electronic resources and digital resources are the same concept, differing only in expression, dominates the sample, with 113 documents (over 90%) holding this position. Specifically, the "equivalence view" can be subdivided into three types:

(1) **Mixed usage in text**: In some literature discussing electronic or digital resources, authors do not directly clarify the relationship but use both concepts interchangeably in different parts of the same article/book, and contextual reading reveals they refer to the same meaning, thus inferring the author actually treats them as the same concept. This corresponds to the "indirectly indicating equivalence in text" item in Figure 1, with 19 documents (16.8% of the sample). For example, some scholars researching digital reading promotion use both terms multiple times in their articles, primarily to elaborate on library digital resource promotion and marketing [21], without distinguishing between the two, both referring to library digital information resources. Similarly, when discussing literature asset management in metadata repositories, digital resources and electronic resources appear multiple times in the text [22], both repre-

senting digital literature resources as opposed to paper literature. The same phenomenon exists in foreign academia. For instance, D. Chulkov et al., when investigating university students' choices between electronic and printed resources, used both "electronic resources" and "digital resources" as indicators, clearly treating the pair as synonyms [23]. Similarly, T. Sanches et al., when discussing factors influencing students' research and learning abilities in Portuguese higher education, used digital resources, e-books, and discovery systems as main research objects, also without distinguishing between e-resources and digital resources, both representing digital learning resources affecting student learning efficiency [24]. V. Yapparova, in an article on digital resource guidelines and feedback, used "electronic resources" and "digital resources" multiple times in the abstract, both referring to various modern learning resources used in education [25].

(2) **Directly stating they are the same concept**: In the sample, 13 documents (11.5%) directly state that electronic resources and digital resources are the same concept, i.e., explicitly indicating they are different expressions of the same concept. These documents straightforwardly propose that digital resources, digitized resources, and electronic resources are synonyms [26], or that digital resources, electronic resources, and electronic publications are the same concept [27-29], or that digital resources, electronic resources, and academic databases refer to the same object [30], or merge electronic and digital resources as synonyms in quantitative analysis [31]. From their expressions of the relationship, they do not mention any differences between the two, i.e., they consider electronic resources and digital resources to be the same concept.

(3) **Inferring sameness from definitions**: Although many documents do not directly or indirectly mention the conceptual relationship between electronic resources and digital resources, investigation reveals that among documents mentioning their definitions, 81 documents (71.7% of the sample) express identical definitions. Representative domestic viewpoints include: Wu Junqing et al. define electronic resources as products storing information digitally on optical, magnetic, and other media, readable through computers or similar devices [32]; Suo Chuanjun defines electronic or digital resources as information disseminated in digital form and read through computers [33]. Ma Feicheng defines digital resources as all information storing text, images, sound, and other forms on non-paper carriers such as optical and magnetic media, reproduced through networks, computers, or terminals [34]. Meng Guangjun considers digital resources as information resources released, accessed, and utilized in digital form through the integration of computer technology, communication technology, and multimedia technology [35]. Xiao Ximing proposes that digitized information resources refer to information resources storing text, images, sound, and other forms on non-paper carriers such as optical and magnetic media, transmitted through optical and electrical signals, and reproduced through computers and other external devices [36]. Wu Weici defines digi-

tal resources as resources stored in computers or related media, accessible through network data transmission, information retrieval, and access, with formats including text, images, audio-video, and multimedia [37].

In foreign literature, D. Swain et al. define electronic resources as resources storing information electronically and accessible through electronic systems and networks, including OPACs, CD-ROMs, online databases, e-journals, e-books, internet resources, print-on-demand (POD), email publishing, online publishing, and network publishing [38]. D. Chulkov et al. propose that digital resources are resources published in digital form and read by computers [23]. A. Kaladhar et al. consider digital resources as datasets accessed through computers or all electronic products, which can be full-text databases, e-journals, image collections, and other multimedia products [39]. Through inductive summary, both definitions mainly elaborate on: resource existence form (electronic data/digital form/binary code), manifestation form (text/image/sound/animation, etc.), carrier form (non-paper media such as optical/magnetic), and transmission and access methods (network/computer/terminal, etc.), thus inferring that electronic resources and digital resources have consistent definitions, i.e., they are the same concept.

Reviewing the above literature reveals a problem: current academia lacks specialized, systematic basic theoretical research on terminology in the information resources field. The vast majority of literature only mentions the concepts or relationship of electronic and digital resources in a perfunctory manner when discussing related issues, or even directly skips or avoids them. Therefore, based on existing research, this study takes the two terms as research objects, explores their relationship, and proposes standardized usage recommendations to fill gaps in current research.

---

4 Usage of the Two Concepts

4.1 Investigation of Term Usage in Chinese and Foreign Literature

4.1.1 Research Methods and Data Sources

This section conducted subject searches for "electronic resource" and "digital resource" in CNKI, excluding conference announcements and call for papers, yielding 10,461 and 15,597 documents respectively, covering journal articles, dissertations, newspapers, etc. For foreign research, the Web of Science database was searched using TS="electronic resource*" or TS="e-resource*" and TS="digital resource*," yielding 6,040 and 7,529 results after data cleaning, including journal and conference papers. The search period ended on December 31, 2020.

To comprehensively understand academic usage of the two terms, related terms such as electronic publications, electronic information resources, and digitized (information) resources were included. Therefore, "research literature using electronic resources" in this section refers to literature whose research theme

includes electronic resources and uses electronic resources or related terms in the text, and digital resources are treated similarly. By tracing the publication timeline of relevant literature, this study attempts to clarify academic usage trends for these two terms.

4.1.2 Usage in Chinese Literature

Chinese research using and studying electronic resources began significantly earlier than digital resources. Domestic usage and research of electronic resources started in the 1980s, while literature on digital resources only began appearing after the 1990s (see Figure 2 [Figure 2: see original paper]). Entering the 21st century, literature volume for both terms began rapid growth. In the early 21st century and before, literature on electronic resources consistently outnumbered digital resources. Around 2010, research using digital resources began to surpass electronic resources, with the growth rate increasing, while literature using electronic resources showed slow growth, gradually widening the gap. By 2012, literature using digital resources peaked, with growth trends stabilizing, while literature using electronic resources began declining year by year.

This phenomenon occurred because: in the 1970s-1980s, electronic resources emerged in China's library and information field; from the late 1990s to early 21st century, the introduction and development of computer technology and the internet brought digital resources into the scope of Chinese academic research; after 2010, the big data era swept in, making digital resource development even more unstoppable, with related literature rapidly increasing.

4.1.3 Usage in Foreign Literature

Corresponding to the domestic situation, foreign literature using electronic resources also began earlier than digital resources, originating around the 1970s, while digital resources started around the 1980s. Research publication volume for both terms gradually increased after the 1990s until the late 20th century, when digital resource research began surpassing electronic resources. Around 2012, both maintained slow growth trends. After 2012, digital resource research publication volume showed explosive growth, peaking in 2018, while electronic resource research trends remained relatively stable. This trend formation is similarly inseparable from the emergence and development of electronic computers and information technology. See Figure 3 [Figure 3: see original paper].

Comparison reveals obvious similarities and differences in the publication of literature using electronic and digital resources in domestic and foreign research. Both show this trend: academic usage of electronic resources preceded digital resources by 5-10 years, with initial publication volume consistently greater for electronic resources until a certain stage when digital resources began to surpass it, with electronic resource literature growth stabilizing in later stages. From the late 20th century, domestic and foreign research publication trends for electronic resources differed significantly, with domestic usage declining while foreign usage maintained slow growth. Overall, the emergence, development, and innovation

of new technologies are the main factors affecting research quantity and changing trends for these two terms in academia.

4.2 Investigation of Term Usage on Chinese and Foreign Library Websites

4.2.1 Research Methods and Data Sources

To further clarify the distinction and usage of the two terms in practice, this study used network survey methods to investigate 89 representative public libraries, university libraries, and research institute libraries in China (81 mainland, 8 Hong Kong, Macau, and Taiwan) and 77 representative public and university libraries abroad, totaling 166 libraries. Website categories and related explanations for the two terms were surveyed from January 10-20, 2021. Due to historical reasons, technology, culture, and economic development in Hong Kong, Macau, and Taiwan have been more influenced by foreign countries, so this study investigates these regions' libraries together with foreign libraries for comparison with mainland China libraries.

4.2.2 Usage in Mainland China Libraries

The mainland China library website survey included 32 provincial-level and above public libraries (including the National Library), 36 "Double First-Class" university libraries, and 13 research institute libraries. By accessing these libraries' official websites and browsing relevant navigation and category settings, term usage for electronic and digital resources was obtained as shown in Table 1 .

Among these 81 library websites, 6 public libraries, 10 university libraries, and 10 research institute libraries did not use electronic or digital resource-related expressions, or could not be accessed due to domain restrictions. Among the remaining 53 libraries using these terms, 20 public libraries used "digital resources" while only 1 used "electronic resources." Two libraries used both terms interchangeably, such as Yunnan Library and Shaanxi Library. Tibet Library placed "electronic resources" as a subcategory of "digital resources." Among university libraries, 20 used "electronic resources" and 5 used "digital resources." One university library used both terms interchangeably. Among the remaining three research institute libraries, two used "electronic resources" and one used "digital resources."

Thus, public libraries using "digital resources" far outnumber those using "electronic resources," while university libraries show the opposite pattern, with more using "electronic resources." Research institute libraries basically balance usage of both terms. Overall, among all three types of libraries surveyed, the number using "digital resources" is slightly higher than those using "electronic resources."

4.2.3 Usage in Hong Kong, Macau, Taiwan, and Foreign Libraries

The survey included 4 public and 4 university libraries from Hong Kong, Macau, and Taiwan, plus 38 national/regional libraries and 39 university libraries from Asia, America, Europe, and Oceania, totaling 42 public libraries and 43 university libraries. Using the same method, website usage of "electronic resource(s)/e-resource(s)" and "digital resource(s)" was investigated. Results are shown in Table 2 .

Among the 42 public library websites surveyed, excluding 28 libraries that did not use either term or could not be accessed, the remaining 14 libraries included 8 using "electronic resource(s)/e-resource(s)" and 4 using "digital resource(s)." The British Library and the National Library of Scotland listed "e-resources" as a subcategory of "digital resources," with "digital resources" as the broader category, including audiovisual resources, databases, digitized resources, electronic resources, etc. Among university libraries, excluding 26 that did not use either term or could not be accessed, all remaining 17 libraries used "electronic resource(s)/e-resource(s)." Thus, representative libraries in Hong Kong, Macau, Taiwan, and abroad use "electronic resource(s)/e-resource(s)" far more than "digital resource(s)."

4.2.4 Summary and Analysis

Analysis of library website survey results reveals that domestic and foreign libraries have varying degrees of unclear concepts and mixed usage of the two terms in practice. Overall, mainland China libraries tend to use "digital resources," while Hong Kong, Macau, Taiwan, and foreign libraries prefer "electronic resources." In mainland China, more libraries use "digital resources" than "electronic resources," while the opposite is true in Hong Kong, Macau, Taiwan, and abroad. Given historical factors, library development in Hong Kong, Macau, and Taiwan has been mainly influenced by foreign practices, so these regions are not analyzed separately in subsequent discussion but are compared together with foreign libraries against mainland China libraries (hereinafter "domestic libraries").

Comparing different library types reveals that mainland public libraries commonly use "digital resources," while university libraries predominantly use "electronic resources." In Hong Kong, Macau, Taiwan, and abroad, both public and university libraries commonly use "electronic resources."

The three domestic libraries that use the terms interchangeably are all domestic libraries; no foreign library websites exhibit this phenomenon. Among them, two provincial libraries use both terms interchangeably, referring mainly to purchased databases, audio, and video resources. One university library using both terms interchangeably also refers to database resources. This suggests that libraries using both terms interchangeably believe digital and electronic resources have no obvious difference, both referring to database resources provided by libraries.

Three libraries domestically and abroad establish an inclusive relationship between the terms, all treating electronic resources as a subcategory of digital

resources. The British Library and the National Library of Scotland's websites both include digitized collection resources and audiovisual resources (such as digitized paintings, electronic maps, etc.) and electronic resources under "digital resources." The British Library explains electronic resources as "various electronic or non-print items collected by the library that can provide multi-content access through subscription." The National Library of Scotland's electronic resources mainly include digitized books and journals, network resources, databases, e-journals, and e-newspapers. From this, it can be inferred that the difference between electronic and digital resources in these libraries is that digital resources include digitized content of traditional paper collections, while electronic resources do not include these digitized collections. Tibet Library's "digital resources" category includes Chinese and foreign databases as subcategories, with "electronic resources" as a subcategory under Chinese databases, listing only Tsinghua Tongfang reference database.

Analysis of these phenomena can be summarized into two reasons:

(1) **Different language usage habits cause terminology differences between domestic and foreign libraries.** When electronic technology first emerged in the 20th century, foreign countries, with favorable technological environments, first developed electronic resources and used this term in theoretical research and practical activities. Later, with digital technology development, digital resources emerged as a new term, but because the referred content did not differ significantly, the term electronic resources continued to be used. China's introduction of electronic resources occurred relatively late. When electronic resources first emerged, China did not participate extensively in electronic resource construction, with limited theoretical research and practical application, and only a few libraries used electronic resources. Later, with the development of digital resources and the big data environment, domestic academic research and practical activities flourished, giving substantial attention to digital resources. Consequently, digital resources began large-scale usage in China, presenting a phenomenon of simultaneous use of electronic and digital resources, with the newer term digital resources receiving greater attention.

(2) **Different resource emergence times cause terminology differences between domestic public and university libraries.** Generally, university libraries, as frontiers of education and research, are more sensitive to new technologies and resources than public libraries. Meanwhile, university libraries have advantages over public libraries in funding and technology, and their acceptance of new technologies and resources is also higher. Therefore, after electronic resources developed to a certain stage abroad, university libraries were the first to introduce them and used relatively advanced electronic technology to carry out electronicization of collection resources and build self-constructed electronic resources. Thus, university libraries domestically were the first to use the term elec-

tronic resources and continue to this day. Public libraries, constrained by development levels, began noticing electronic resources only after digital resources had already started rising. Therefore, riding this wave, public libraries directly "skipped" the electronic resources stage and began adopting the newer term digital resources.

---

5 Comparative Analysis of Electronic and Digital Resource Concepts

Based on theoretical and practical investigations, this study argues that in contemporary contexts, electronic resources and digital resources share the same essential connotation, essentially a pair of "old and new terms." Broadly defined, they are resources existing in digital form, using non-paper media such as optical and magnetic carriers, transmitted and accessed through network communication/computer/terminal methods, with multiple manifestation forms including text, images, sound, and animation. However, examining the two terms from the perspectives of their emergence and development and key technologies employed reveals subtle differences, which constitute the deep reason for current mixed usage in academia and practice.

5.1 Distinguishing Characteristics

5.1.1 Temporal Origin

As important forms of information resources, both electronic and digital resources originated in Western countries, with their most fundamental difference being different times of emergence. Electronic resources can be traced back to the application of electronic products in the information field. In early 20th century, electronic technology centered on vacuum tubes emerged in developed countries, followed by electronic products like radios, televisions, magnetic tapes, and videotapes, with the earliest electronic resources arising accordingly. Until around the 1980s, electronic resources began appearing in China's library field, represented by electronic publications (especially e-journals). Digital resources, however, emerged with the birth of electronic computers in the late 1940s. In 1946, the world's first electronic computer was produced, but computers were not yet applied to information processing. Not until the late 1960s did the U.S. National Library of Medicine develop the MEDLARS database for medical literature retrieval, representing the birth of the earliest digital resources [15]. In early 1970s, the U.S. Library of Congress officially issued MARC machine-readable cataloging, widely applied in North American libraries. However, during this period, information resources primarily on magnetic and optical media such as disks and CDs were still mainly called "electronic resources." Only by the late 20th and early 21st centuries, with rapid computer and internet development, did various media-independent information resources (such as various databases, e-books, e-journals, academic papers, open access resources,

etc.) begin to be widely called "digital resources" [40], and digital resources began rapid development. Therefore, from temporal origin and development stages, the two terms differ.

5.1.2 Key Technologies

The main difference between electronic and digital resources lies in the key technologies employed. As the names suggest, electronic resources use electronic technology, while digital resources use digital technology. In electronics, signals transmitted, processed, and handled can be divided into two categories: analog signals, characterized by continuous variation in both time and signal magnitude, with analog technology used to transmit, process, and handle them, typical products being radios and tape recorders; and digital signals, characterized by discrete (discontinuous) sequences of 0s and 1s in both time and magnitude, with digital technology used to transmit, process, and handle them, represented by electronic computers and networks. Compared with analog electronic technology, digital technology has many advantages: processing massive information, high-definition transmission, strong anti-interference capability, high precision, convenient long-term storage, and good confidentiality [41-42].

However, since the 1990s, due to digital technology's inherent advantages and rapid development of computer network technology, digital technology's rapid rise has prompted many technologies to shift from analog to digital and composite forms. Traditional analog technology has been gradually replaced by digital technology in various fields. Audio equipment, video, and image technology, as the last strongholds of traditional analog technology, also entered the digital revolution stage in early 21st century [43]. Especially in the big data era, information resources in multiple media forms continuously emerge, with digital characteristics intensifying. Traditional electronic resources can no longer encompass diverse digital resources with era characteristics. Therefore, in current contexts, electronic resources mainly refer to digital resources, with the final distinction resting on temporal change.

5.2 Rationale for Synonymy

However, the above differences do not hinder concluding that the two terms are synonymous. Although this conclusion appears contradictory, it is actually a choice made after weighing various factors. It must be emphasized that the "synonymy" referred to here is based on current era backgrounds and research contexts, aiming to facilitate usage while ensuring terminology standardization. The conclusion ultimately emphasizes that they are a pair of "old and new terms." This rationale is demonstrated from three angles: connotation changes, term evolution, and conventional practice.

5.2.1 Connotation Changes

Examining connotation changes still requires starting from technical differences. Literature review reveals that resources like CDs and disks also belong to digi-

tal resources. Taking microfilm technology as an example, traditional microfilm used analog technology with film as the single carrier, strictly belonging to electronic rather than digital resources. However, with development, to preserve microfilm's advantages while compensating for its defects, microfilm technology has gradually evolved into analog-digital composite technology combining film, disks, CDs, and other carriers, now widely applied in archives preservation [44]. This composite technology mainly uses optical principles to transfer digital information to microfilm, then uses digital technology for reading, transmission, and utilization [45]. Microfilm using this technology undoubtedly belongs to digital resources. Similarly, modern disks have gradually become products digitizing analog signals. The earliest CDs in early 1980s were applied to music recording, with analog technology used in production itself, but music on CDs was stored using digital technology. Over time, people began using CDs to store diverse digital information [46]. Therefore, with technological upgrading and high compositization, subtle differences between electronic and digital resources are disappearing. Digital resources' meaning has actually expanded, and in many research and practice fields, digital resources is used to refer to resource types opposite to paper resources. Thus, categorizing them as "synonymous" in contemporary contexts conforms to terminology connotation development trends.

5.2.2 Terminological Evolution

Digital and electronic resources show an old-new replacement trend, being terms with specific era characteristics generated in different historical periods, similar to the pair "electronic library" and "digital library," both reflecting different development stages of libraries. Literature usage trends show that before the 1990s, both domestic and foreign academic research mainly used "electronic resources" as the primary term, which domestic university libraries have continued. After the 1990s, with information technology development, just as "electronic library" was gradually "eliminated," "electronic resources" usage declined, with usage scenarios and frequency gradually decreasing, while "digital resources" began widely appearing in research across various fields. Academic usage of the two terms clearly shows a seesaw pattern. A major characteristic of the transition from "electronic resources" to "digital resources" is the emergence of various multimedia resources. The past term "electronic resources" gradually became inadequate for digital era development needs, insufficient to reflect current era characteristics, and gradually evolved into "digital resources." From this perspective, digital resources are more inclusive and innovative.

The notion that they are old and new terms is not unfounded. Some scholars directly state: "When digital resources were still called 'electronic resources,'…" [47], " 'Digital resources' and 'electronic resources' have obvious historical traces,… with no essential difference" [48]. Others, when discussing development stages of scientific literature publishing, propose: "From print to publishing, print and electronic resources coexisting, to pure electronic publishing,… reflecting the transformation of digital information resources…" [49], also demonstrating this viewpoint from a publishing perspective.

5.2.3 Conventional Practice

Literature review shows that current academic views on the relationship are dominated by the "equivalence view," i.e., considering electronic and digital resources as different terminological expressions of the same concept. Only very few scholars explicitly elaborate on an inclusive relationship without providing clear reasons, and these views have not attracted widespread attention in academia. Moreover, for a long time, both academia and the general public have been accustomed to discussing electronic or digital resources in opposition to paper resources, considering them a pair of opposite concepts, which indirectly confirms the widespread belief that electronic and digital resources are synonyms. This claim has been widely used from the early development of digital resources to the present. Therefore, from the perspective of convention and usage habits, defining electronic and digital resources as different terminological expressions of the same concept, while clarifying their "old-new" characteristics in development stages, has strong explanatory and generalizability power for current development environments, and also has developmental applicability for the long digital development stage ahead.

In summary, when exploring the relationship between electronic and digital resources, we should respect their subtle differences in origin while combining era development and actual usage to avoid overcorrection, striving to have standards without losing "respect," and order without lacking "flexibility." On the basis of acknowledging differences, categorizing them as synonymous from academic standardization and practical development perspectives, while clarifying and defining some special usage situations and scopes, helps improve terminology standardization and ensures consistency and continuity in academic research and practical development.

---

6 Standardized Usage Recommendations for the Two Terms

As basic concepts of a discipline, whether terminology is used standardly directly affects the establishment of the discipline's basic theoretical system. Disciplinary research relies on related terminology expression. Any discipline must have its own professional terms and matching conceptual system, and build related theories and methods for research on this basis. Moreover, clarifying usage standards for electronic and digital resources helps smoothly carry out practical work such as library resource procurement and construction, user resource access, and publishing department planning. Therefore, it is particularly important to standardize usage scenarios and precautions for electronic and digital resources.

6.1 Theoretical Domain

Based on the above research on concepts and relationships, this study believes that under the premise of clearly expressing terminology concepts while respect-

ing conventions, electronic resources and digital resources can be used synonymously, with "digital resources" as the primary "standard term" and "electronic resources" as the synonym. However, attention must be paid to rigor when used in academic literature, government and other official documents, and professional dictionaries and other reference books. Specifically, in formally published documents such as journal articles, dissertations, monographs, textbooks, newspapers, and government documents, terminology usage should be strictly consistent throughout, avoiding mixed usage. When compiling and revising textbooks, particular attention should be paid to standardized expression of this term pair. According to curriculum plans, clarify whether it is necessary to use both terms simultaneously. If not, ensure consistency throughout; if necessary, systematically and comprehensively elaborate on the origins of electronic and digital resources. Existing dictionaries and glossaries in library and information science should also supplement and include these two terms, setting appropriate cross-references or in-text references according to actual conditions to clarify the relationship and guide standardized usage.

To promote standardized usage in academia, relevant stakeholders should work together. The National Terminology Committee can supplement and improve this term pair in terminology databases; library and information education institutions, academic communities, and academic journals should play a role in advocating, supervising, and guiding terminology standardization; professionals should continue to promote perfection of this term pair's concepts and related standards, dedicated to terminology system development; for each researcher, clarifying the relationship between electronic and digital resources is fundamental to conducting related research, and should not be passively avoided or ambiguous. Joint efforts should break the current situation of fragmented practices.

6.2 Practical Domain

It should be particularly noted that in practical domains, many library practitioners habitually use the concept of "electronic resources" to collectively refer to third-party commercial digital resources obtained through purchase and other means [48], but this usage has not gained universal recognition in the industry and remains controversial. Therefore, from an academic standardization perspective, standardized usage should also be clarified in library practice. It is recommended that when electronic resources (or digital resources) are specifically used in library practice, reference can be made to the definition by the Ministry of Education's University Library Committee, referring to "digital literature resources in magnetic or optical media or with network usage rights, introduced (purchased, leased, and donated) or self-built (including scanned, converted, and input) by libraries" [50]. Therefore, on the premise of respecting existing usage habits, by clarifying specific contexts for terminology usage, the library practice field can choose to follow tradition and continue using "electronic resources" (preferably noting its synonymy with "digital resources"), hoping to enhance industry recognition and gradually promote consensus and terminology

standardization.

Apart from libraries, press and publication, archives, and other institutions also cannot do without electronic and digital resources in work processes such as acquisition, procurement, and resource preservation. These units need to clearly understand the scope and relationship between electronic and digital resources, analyzing specific issues specifically. Under normal circumstances, the two can be used synonymously, with "digital resources" as the standard term. In fact, with the advancement of the digital wave, almost no practice domain can completely "separate" from the relationship between electronic and digital resources. Therefore, relevant institutions should actively clarify specific work objects and scopes when carrying out related work, promote standardized development of related work, and accelerate consensus-building.

References

[1] COILER. Periodical literature for electronic engineers[J]. Proceedings of the IRE, 1950, 38(12): 1380-1384.
[2] EVANS C. Strategy for energy-conservation through tribology-electronic-resources-development-agency[J]. Energy policy, 1978, 6(2): 170-171.
[3] ABBOTT P, KAVANAGH R. Electronic resource sharing changes interloan patterns[J]. Library journal, 1986, 111(16): 57-58.
[4] LIU Zhengzhi. Electronic Libraries and Their Construction[J]. Library and Petroleum Science and Technology Information, 1995, 9(4): 31-32.
[5] THOMPSON D, BREWER J, BRANDT F, et al. Dynamic network for digital resource allocation[J]. Instrumentation in the pulp and paper industry, proceedings, 1980, 2(5): 3.
[6] MA Kum. Protection Work in the Digital Domain[J]. JIA Guiren, trans. Micrographics, 1998, (3): 35-41.
[7] XU Suiwen. Random Notes IV: Creation of Digital Resources—SGML and Metadata[J]. Journal of the National Library of China, 1999(1): 41-42.
[8] QIU Dongjiang. Dictionary of Library and Information Science[M]. Beijing: Ocean Press, 2013.
[9] ZHOU Wenjun. Dictionary of Library and Information Science[M]. Beijing: Bibliographic Literature Publishing House, 1991.
[10] BAI Yingcai. English-Chinese Dictionary of Information Technology[M]. Shanghai: Shanghai Jiao Tong University Press, 2014.
[11] CEAAL/CALIS/DRAA China-US Joint Working Group. National Information Standards Organization (NISO) Electronic Resources Standards and Specifications (Chinese Version)[EB/OL]. [2021-01-28]. http://www.libconsortia.edu.cn/Standard/list.action.
[12] INSTITUTIONS(IFLA). Key issues for e-resource collection development: a guide for libraries[EB/OL]. [2021-01-28]. https://www.ifla.org/publications/key-issues-for-e-resource-collection-development-a-guide-for-libraries.
[13] ZHANG Shengqiang. Research on Digital Resource Evaluation Index System[D]. Chengdu: Sichuan University, 2004.

[14] DONG Ke. Research on Multivariate Bibliometric Aggregation of Scientific Knowledge[M]. Wuhan: Wuhan University Press, 2017.
[15] ZHANG Shaowu. Research on Long-term Preservation of Digital Information Resources[M]. Kunming: Yunnan Science and Technology Press, 2015.
[16] YIN Zhanlu, HU Nian, TIAN Xuesong. Research on Digital Information Resources[M]. Tianjin: Tianjin Science and Technology Press, 2015.
[17] ZENG Jianxun, DENG Shengli. Analysis of Resource Construction and Service Development of the National Science and Technology Library[J]. Journal of Library Science in China, 2011, 37(2): 31-32.
[18] LOP, CHO A, LAW B, et al. Progressive trends in electronic resources management among academic libraries in Hong Kong[J]. Library collections, acquisitions, & technical services, 2017, 40(1/2): 28-37.
[19] HUANG Jingliang. Research on the Allocation and Utilization of Digital Resources in University Libraries[D]. Wuhan: Central China Normal University, 2013.
[20] ZHANG Qin. Research on the Utilization of Foreign Language Electronic Resources in University Libraries in Anhui Province[D]. Hefei: Anhui University, 2012.
[21] MAO Yihong, MA Kunkun. Analysis of Research Status and Trends on Digital Reading Promotion at Home and Abroad[J]. Library Tribune, 2017, 37(7): 9-16.
[22] SUN Rui, YANG Xinya, LIAO Wei. Literature Asset Management Built on Metadata Repository[J]. Journal of Academic Libraries, 2019, 37(1): 55-66.
[23] CHULKOV D, VAN ALSTINE J. College student choice among electronic and printed textbook options[J]. Journal of education for business, 2013, 88(4): 217-218.
[24] SANCHES T, BORGES M. New data on knowledge and application of information literacy framework in higher education libraries: results of a questionnaire survey to Portuguese librarians[J]. Qualitative & quantitative methods in libraries, 2019, 8(4): 562-564.
[25] YAPPAROVA V, MIFTAKHOVA A. Guidelines and feedback as components of a digital resource[M]//CHOVA L, MARTINEZ A, TORRES I. Edulearn19: 11th international conference on education and new learning technologies. Valenica: Iated-Int Assoc Technology Education & Development, 2019: 7097-7098.
[26] AN Yueying, JIN Jianjun. Theory and Practice of Digital Libraries[M]. Xi'an: Xi'an Map Publishing House, 2010.
[27] NIE Yunxia. Research on National-Level Long-term Preservation Strategies for Digital Resources[D]. Wuhan: Wuhan University, 2014.
[28] WANG Yi. Research on Quality Modeling and Control of Digital Resources Oriented by User Satisfaction Experience[D]. Changchun: Jilin University, 2014.
[29] WANG J, PRIBYLA A. The nature of the digital resource: how the process for the management of digital resources differs from (and is the same as) that of other formats[J]. Collection management, 2008, 32(1/2): 142-144.
[30] LI Aiguo. Introduction and Management of Academic Digital Resources[M].

Nanjing: Southeast University Press, 2005.
[31] ZHAO Rongying, ZHAO Junyin, CHEN Bikun. Perspective on Research Themes and Trends in the Discipline of "Library, Information and Archives Management"—From the Perspective of National Science Funds from 2001-2012[J]. Information Studies: Theory & Application, 2014, 37(2): 1-5.
[32] WU Junqing. Practice of Performance Evaluation Theory and Methods in Research Institutions[M]. Beijing: Scientific and Technical Documentation Press, 1992.
[33] SUO Chuanjun. Digital Collection Evaluation and Performance Analysis[M]. Beijing: Beijing Library Press, 2007.
[34] MA Feicheng, et al. Research on Digital Information Resource Planning, Management and Utilization[M]. Beijing: Economic Science Press, 2012.
[35] MENG Guangjun. Latest Theoretical and Practical Research on Library and Information Science Abroad[M]. Beijing: Science Press, 2009.
[36] XIAO Ximing. Information Resource Construction[M]. Wuhan: Wuhan University Press, 2008.
[37] WU Weici. Library Information Resource Construction in Network Environment—Also on the Current Situation and Development Trend of Database Industry[J]. Library Tribune, 2004, (6): 11-12.
[38] SWAIN D, PANDA K. Use of electronic resources in business school libraries of an Indian state—a study of librarians' opinion[J]. Electronic library, 2009, 27(1): 74-85.
[39] KALADHAR A, NAICK D, SOMESHEKHARA RAO K. Digital resources and services awareness, use and other aspects amongst the students of JNTUK-Kakinada: a study[J]. Library philosophy and practice, 2018, 14(26): 23-24.
[40] YIN Hong, LIU Wei. New Generation Library Service System: Functional Evaluation and Vision Outlook[J]. Journal of Library Science in China, 2013, 39(5): 26-33.
[41] WU Xianding, LI Haixia. Introduction to Electronic Information Engineering[M]. Beijing: National Defense Industry Press, 2013.
[42] XU Zhenglin. New Media, New Marketing and New Advertising Concepts[M]. Shanghai: Shanghai Jiao Tong University Press, 2010.
[43] ZHANG Wenjun. Contemporary Media New Technologies[M]. Shanghai: Fudan University Press, 1998.
[44] FENG Ning, WEI Xiaobo, PU Jinquan. Application of Analog and Digital Technologies in Archives Management[J]. Digital and Micrographics Imaging, 2006(03): 6-7.
[45] LUAN Ningli. Application of Digital Micrographics Technology in Archives and Document Management[J]. Archives and Construction, 2019(5): 55-56.
[46] KASDORF. Columbia Guide to Digital Publishing[M]. Suzhou: Soochow University Press, 2007.
[47] LIU Jiayin. Research on Comprehensive Evaluation of Digital Resource Utilization Efficiency in Domestic Universities[D]. Wuhan: Wuhan University, 2013.
[48] LI Shuning. Standardized Management and Control of Library Electronic Resource Procurement[M]. Beijing: China Economic Publishing House, 2019.

[49] ZENG Jianxun. Development Considerations for NSTL Resource Construction in an Open and Integrated Environment[J]. Journal of Academic Libraries, 2020, 38(6): 63-70.
[50] Steering Committee for Academic Libraries of the Ministry of Education. Guidelines for Digital Resource Measurement in University Libraries (2007)[EB/OL]. [2021-01-27]. http://www.scal.edu.cn/tjpg/201311191006.

Author Contributions:
Xu Qingmei: Conceptual design, data investigation and collection, paper writing and revision;
Tao Rui: Data investigation and collection, paper writing and revision;
Ye Jiyuan: Topic determination, guidance on ideas, paper revision.

Note: Figure translations are in progress. See original paper for figures.