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EARLY VIEW

Global and China's Perspectives on Digital Literacy Education: A Comparative Citespace Analysis

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Abstract: The ever-evolving digital ecosystem presents both opportunities and challenges for individuals, communities, and societies at large. Against this backdrop, education plays a critical role in equipping learners with the necessary competencies to harness the potential of digital technologies while mitigating associated risks. This study presents a comprehensive comparative analysis that provides educators with a new perspective on digital literacy. Leveraging CiteSpace to scrutinize two databases Web of Science (WoS) and China National Knowledge Internet (CNKI) separately, the analysis visually depicts the developmental trajectory of digital literacy research, identifies key thematic areas, and unveils potential research gaps. Within the international context, digital literacy research in WoS showcases a strong focus on practical applications, exploring its effects across diverse domains such as related literacy. Conversely, CNKI research predominantly delves into theoretical aspects, making notable contributions to the formulation of conceptual frameworks and interdisciplinary explorations of digital literacy. Emerging trends indicate an increasing emphasis on digital ethics, misinformation, and data privacy. The research pinpoints research gaps among Chinese educators and policymakers, leading to a comprehensive understanding of digital literacy and offering fresh perspectives for future investigation. Given the pressing importance of digital literacy in the contemporary era, there arises an imperative to introduce and integrate education-oriented curricula within the Chinese educational system, thereby fostering a more profound and comprehensive pursuit of digital literacy among its learners.

Keywords: Citespace, Comparative Analysis, Digital Literacy, Research Gaps, Systematic Review

INTRODUCTION

Education, as a fundamental mechanism for knowledge dissemination and cognitive development, has undergone a profound transformation in response to the digital revolution. The advent of the digital era has necessitated a reevaluation of curricula and pedagogical approaches to incorporate digital literacy as a core competency, recognizing its central role in preparing learners for an interconnected world. This paradigm shift aligns with the broader objectives of education in fostering critical thinking, problem-solving, creativity, and adaptability—skills that are indispensable in the digital age.

The conceptualization of digital literacy has evolved over time, with scholars contributing nuanced perspectives to the field. Initially defined by Gilster (1997) as the ability to comprehend and utilize information from diverse digital resources with the aid of computers, digital literacy has since expanded to encompass a wide array of skills and competencies. Researchers such as Martin & Grudziecki (2006), Calvani (2012), Janssen (2013), Tabusum et al. (2014), Walton (2016), Choi et al. (2017), and Havrilova & Topolnik (2017) have broadened the scope to include technology, cognition, ethics, communication, social literacy, digital sharing, creativity, participation, and critical ability.

In recent years, scholars have emphasized various dimensions of digital literacy. List (2019) highlighted the capacity to glean understanding from resources within computers and the internet, while Van Laar et al. (2020) underscored seven digital skills—technical, information, communication, collaboration, critical thinking, creativity, and problem-solving—as determinants of digital proficiency.

Digital literacy, therefore, encompasses a multitude of aspects, including ability, awareness, interaction, and norms. It represents a comprehensive set of qualities and abilities spanning digital acquisition, usage, evaluation, sharing, innovation, security, and ethical considerations (Jiang & Zhai, 2022). Despite decades of scholarly attention and the emergence of frameworks, the motivations driving individuals to apply digital literacy in their lives remain a subject of ongoing investigation.

As asserted by Bawden (2008), digital literacy cannot be universally applicable and must be tailored to the diverse needs of individuals, accounting for factors such as age, region, physiological, and psychological considerations. Thus, digital literacy is a complex and evolving domain of study.

While significant efforts have been dedicated to conceptualizing and advancing the field, there remains a need for cohesive research initiatives and consensus on motivating factors. As the digital landscape continues to evolve, comprehensive measurements of digital literacy should encompass technology,

societal, cognitive, physiological, and psychological dimensions to effectively adapt to emerging challenges and opportunities.

Addressing research gaps and gaining a deeper understanding of the multifaceted nature of digital literacy will be crucial in shaping future research directions and policy decisions. Therefore, this paper aims to contribute to the ongoing discourse by exploring the intricacies of digital literacy and its implications for education and society.

LITERATURE REVIEW

Digital Literacy Education in the Global Context

Numerous organizations have demonstrated a keen interest in the development of digital literacy frameworks. One such prominent initiative was undertaken by the European Union (EU) in 2007, which played a pivotal role in shaping the Digital Literacy Framework. As a significant milestone, the EU officially launched key competencies for lifelong learning, with digital competence being recognized as one of the eight essential proficiencies for European citizens, marking its formal integration into the European reference framework. This pioneering effort was documented in academic literature, and it set the groundwork for subsequent advancements in the field.

One noteworthy endeavor in the area of digital literacy was the Digital Competence Project (DIGCOMP), conducted by the Institute for Prospective Technological Studies. The project aimed to delineate key competencies and skills necessary for individuals to navigate the digital landscape with acumen, creativity, criticality, and an intercultural perspective across various spheres such as work, leisure, and education (Ferrari, 2013). The outcome of this project, the DigComp1.0 framework, synthesized digital literacy into five distinct domains: information, communication, content creation, security, and problem-solving.

Comparative Analysis of Global and Chinese Approaches

Further contributions to the digital literacy landscape came from researchers like Eshet-Alkalai (2014), who presented a comprehensive digital literacy framework encompassing five interrelated aspects: picture and image literacy, re-creation literacy, branch literacy, information literacy, and social-emotional literacy. This multi-dimensional framework shed light on the intricate nature of digital literacy and its diverse applications in contemporary society.

Greene et al. (2014) conducted insightful research focusing on critical components of digital literacy. Their investigation highlighted two critical facets: first, the efficacy of strategies employed by individuals to plan and monitor their digital activities effectively; and second, the competence to judiciously vet and integrate information sources, ensuring their appropriateness and reliability. This emphasis on critical thinking and discernment in the digital realm underscored the importance of well-rounded digital literacy frameworks.

In subsequent years, further refinements were made to existing frameworks to accommodate the evolving digital landscape. For instance, DigComp2.0 and DigComp2.1, as revised by Carretero et al. (2017), provided expanded insights into areas such as information and data literacy, communication and collaboration literacy, and digital content creation literacy, reflecting the ever-changing technological and societal dynamics.

Beyond the European context, the United States also made significant contributions to the digital literacy discourse. The American New Media Alliance proposed a tripartite digital literacy framework encompassing universal literacy, creative literacy, and literacy specialized within diverse disciplines (Alexander et al., 2016). This approach recognized the need for context-specific digital literacy competencies while emphasizing creativity and adaptability across domains.

Moreover, international efforts were evident in the development of the Global Framework for Digital Literacy (DLGF) by the UNESCO project team, which built upon the foundations of DigComp2.0. The DLGF aimed to be universally applicable, transcending geographical boundarie and encompassed domains like equipment operation and career-related aspects to address the holistic spectrum of digital literacy skills (Law et al., 2018).

In the United Kingdom, the Joint Information Systems Committee (JISC) crafted a digital capability framework with a holistic perspective, comprising six crucial dimensions: ICT level, data and media literacy, digital production and innovation, digital communication and collaboration, digital learning and development, and digital identity and health (Brown, 2018). This comprehensive model underscored the significance of a broad-based approach to digital literacy, acknowledging its multidimensional impact on individuals and society at large.

Additionally, the Digital Intelligence Alliance (CDI) contributed to the field by releasing the global Digital Skills (DQ) framework, encompassing eight vital areas: identity, usage, safety, security, emotional intelligence, communication, knowledge, and rights (Park, 2019). This framework sought

to provide a robust foundation for digital literacy education, bridging the gap between technological advancements and responsible digital citizenship.

The development of digital literacy frameworks has been a concerted effort by various organizations worldwide. These frameworks have evolved over time to encompass diverse domains and address the dynamic nature of the digital landscape. The academic literature underscores the importance of cultivating comprehensive digital literacy skills to empower individuals to thrive in the modern digital era.

Emerging Trends in Digital Literacy Research

The impact of digital literacy on academic achievement has been extensively investigated across various educational contexts. Holm (2024) provides empirical evidence of this relationship in an online anatomy and physiology course, highlighting the importance of digital competence in specialized domains. Kabakus et al. (2023) examine the correlation between digital literacy and technology acceptance among administrative staff in higher education, emphasizing the role of digital skills in enhancing productivity and technological integration. Vice et al. (2024) discuss the benefits and challenges of digital literacy storytelling projects, emphasizing their transformative potential in fostering critical engagement with technology. Low et al. (2023) explore the role of critical digital literacy in navigating algorithmic imaginings on social media platforms, underscoring its implications for information literacy and civic engagement. Rivera-Macias and Casselden (2024) investigate Finnish library responses to digital literacy challenges during the COVID-19 pandemic, highlighting the importance of context-specific interventions. Kim et al. (2023) conduct a scoping review to identify core competencies of digital health literacy, illustrating the interdisciplinary nature of digital literacy. Smeaton (2023) advocates for integrating health literacy and digital literacy in university-level education to address the complex health information landscape. These studies collectively contribute to our understanding of the multifaceted relationship between digital literacy and academic achievement, emphasizing the significance of digital skills in contemporary educational settings.

Digital Literacy Education in China

In China, digital literacy initiatives are often heavily influenced by government agendas and censorship policies. This may lead to a prioritization of content that aligns with state narratives and ideologies, potentially limiting the scope for critical inquiry and diverse perspectives.China's centralized education system may prioritize standardized testing and rote memorization over critical thinking and creativity,

which could impact the effectiveness of digital literacy education. The emphasis on technical skills development may also neglect broader socio-cultural and ethical dimensions of digital citizenship.

Identified Research Gaps

By comparing and contrasting digital literacy publications between CNKI and WoS provides valuable insights into how different cultural, economic, and political contexts influence approaches to digital literacy education and research. In China, digital literacy initiatives often reflect the country's emphasis on education and technological advancement as key drivers of economic growth. There may be a strong emphasis on practical skills development and workforce readiness (Xue, 2023). In Western countries, digital literacy efforts may be more focused on fostering critical thinking, media literacy, and digital citizenship, reflecting broader societal values around individual autonomy and democratic participation.China's centralized education system allows for top-down implementation of digital literacy initiatives, often aligned with national development goals (Feng, 2023). Western countries typically have more decentralized education systems, leading to greater variation in digital literacy programs and approaches across regions and institutions.Chinese digital literacy research may prioritize topics such as technological innovation, digital infrastructure, and the impact of digitalization on economic development. Western digital literacy research may focus more on issues related to privacy, security, online misinformation, and the digital divide, reflecting concerns about individual rights and societal well-being.Digital literacy education in China may prioritize rote learning and technical skills acquisition, reflecting traditional educational values (Hu & Zhang,2024).Western digital literacy programs may emphasize experiential learning, critical inquiry, and collaborative problem-solving, aligning with progressive pedagogical approaches.Despite the extensive body of literature, significant gaps remain, particularly in the Chinese context. Studies by Liu (2018) highlight the need for more empirical research on the effectiveness of digital literacy programs in China. Additionally, there is a lack of comprehensive curricula that address emerging trends such as digital ethics, misinformation, and data privacy. This section underscores the urgency of addressing these gaps to foster a more profound and comprehensive pursuit of digital literacy among Chinese learners.

This study was carried out in order to grasp the current digital literacy focus.The purpose of this study is to identify Chinese academic research domin in digital literacy. To answer those objectives, the following research questions will be examined in this study:

1. What are the characteristics of the research community and the published research on digital literacy?
2. What are the most commonly studied aspects of digital literacy internationally and in China?

3. What are the distinctions in digital literacy between China and the rest of the world?
4. Visualize and analyze the two largest databases, Web of Science and CNKI, for insights into digital literacy research, identify the research gaps in the field of digital literacy.

The contributions of the study include:

1. This study sheds light on the significance of 21st-century digital literacy by providing a comprehensive comparative analysis of digital literacy construction in global and Chinese contexts. By examining the practical applications emphasized in global research and the theoretical frameworks developed in China, the study offers educators a nuanced perspective on digital literacy. This comparative approach not only highlights the diverse methodologies and focuses of different regions but also underscores the importance of integrating both practical and theoretical elements to create a more holistic digital literacy education.
2. The study emphasizes the need for further efforts within the education system to address the identified gaps in digital literacy research. By pinpointing areas such as digital ethics, misinformation, and data privacy, the research suggests that current educational frameworks must be refined and adapted to meet the evolving needs and understandings of digital literacy. This call to action aims to ensure that educational curricula are comprehensive and relevant, equipping learners with the necessary skills and knowledge to navigate the complexities of the digital age effectively.

METHODOLOGY

CiteSpace is a widely used tool for visualizing and analyzing patterns and trends in scientific literature. CiteSpace utilizes bibliographic data from sources like Web of Science, Saga to generate visualizations such as co-citation networks, co-authorship networks, and keyword co-occurrence maps. These visualizations help researchers identify key concepts, influential authors, and emerging trends within a specific field of study. CiteSpace employs algorithms such as cluster analysis, centrality measures, and timeline analysis to uncover meaningful patterns and relationships in the data. Users can customize parameters such as time frame, threshold settings, and visualization layouts to tailor the analysis to their research interests.

CiteSpace is widely used across various disciplines including but not limited to library and information science, biomedical and clinical sciences, computer science and information technology, social sciences such as sociology, psychology, and economics, earth and environmental sciences, physics and engineering, education, management, business administration, cultural studies, and communication

studies. Researchers in these fields frequently utilize CiteSpace for bibliometric analysis and visualization to uncover trends, influential authors, seminal papers, and evolving research topics within their respective domains.

Data Collection Procedure

The literature data of this paper comes from WoS (Web of Science) database, with "digital literacy" as the main topic. A total of 7437 articles were retrieved from January 1, 2004, to July 11 2023. Other literature data in this paper are from CNKI database. In order to ensure the authoritativeness, representativeness, and recognition of literature quality, conferences, newspapers,, and English literature are further screened and excluded, and "digital literacy" is the main topic of search. The deadline for publication is from January 01, 2006 to 2023.07.11, 2006. A total of 1990 articles were retrieved.

Visualization Tool

This study made use of the visual analysis software CiteSpace 6.1.R3, created by Chen (2006). CiteSpace can detect and visualize recent developments in general methods for new trends and fleeting patterns in the body of scientific literature (Chen, 2006). In this paper, citespace6.1r6 was used for visual analysis, the software running time was set as "2006-2023", K=25, and pruning methods were Pathfinder, year-by-year pruning, and overall network pruning. After running, the following graphs were obtained.

Validity and Reliability of the Outputs Produced by CiteSpace

In this study, we assessed the validity and reliability of the outputs generated by CiteSpace, a widely used tool for bibliometric analysis and visualization, across multiple disciplines. Drawing on data from reputable sources such as Web of Science, and CNKI, we conducted a comprehensive review of the literature to evaluate the transparency of CiteSpace algorithms, the reliability of input data sources, and the consistency of results across validation studies and replication analyses. Our findings indicate that while CiteSpace offers valuable insights into patterns and trends within scientific literature, researchers exercise caution and verify the accuracy of input data, validate algorithmic outputs through replication studies and expert review This assessment contributes to enhancing the methodological rigor and reliability of bibliometric research utilizing CiteSpace across diverse academic disciplines.

RESULTS

Keyword Co-occurrence

Keywords are a high generalization of the topic of the paper, co-occurrence analysis by taking keywords as nodes can reflect the changes of hot areas, analysis perspectives, research methods, etc., in different time series, so as to reveal the internal links of disciplines. In this paper, the software running time was set as "2004-2023", the threshold value was set as K=5, YearPerSlice was set as "1", the pruning method was Pathfinder, pruning year by year and pruning the whole network, and visual analysis was carried out. After running, the co-occurrence map of hot keywords in the literature was obtained, as shown in Figure 1. A total of 244 high-frequency keywords were found, forming 283 links. In Figure 1., the size of nodes and text represents the frequency of keyword occurrence, the connections between nodes represent the connections established in different periods, and the thickness and density of connections represent the intensity of keyword co-occurrence. It can be seen that "digital literacy" is the largest node, followed by "literacy" and "media literacy". From the time span calculated in the software, digital literacy, literacy, digital divide, internet, and information literacy appeared earlier. More recently, telemedicine, public health, mental health, digital health literacy, financial literacy, mobile phone, etc. It may become a new direction for future research on digital literacy. (Figure 1)

The intermediary centrality of keywords is an important indicator to judge the research hotspot of this research field, and also an important basis to judge the focus of scholars. From the perspective of the intermediary centrality index representing the node promotion effect (Table 1), the communication between literacy, new literacy, early adolescence, and other hot keywords is strong. At the same time, it can be seen that although the frequency of keywords such as "teaching strategy < strategy" and "to learners in which of the following categories does your work apply" is not high, However, its intermediary centrality is high, indicating that it is often in the communication path with other keywords, which has a positive effect on the mutual reference relationship between literature.

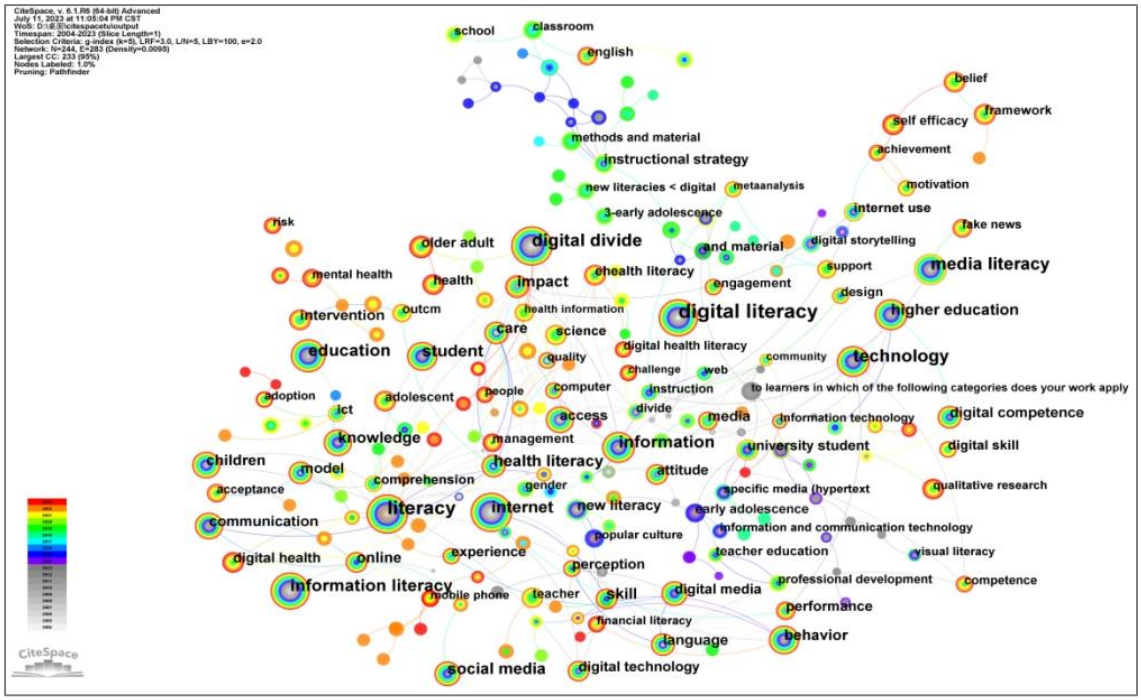

Figure 1. Keyword co-occurrence in WoS

Keywords are the summary of the core content of the literature, and the co-occurrence analysis of high-frequency keywords can capture the research hotspot about Digital literacy. The value of Centrality can reflect the importance and influence of keywords. The greater the value, the greater the mediating role of keywords. After co-occurrence analysis of keywords in the literature in the database, collation is made according to the occurrence frequency of keywords and their intermediate Centrality value (Centrality≥0) (see Table 1.). From the Centrality value of keywords, literacy has the highest centrality value (Centrality= 1.21) and is most closely related to other keywords. Keywords such as new literacy and early adolescence also have high intermediate Centrality values (Centrality≥0.71). Combined with the frequency and centrality of keywords, it can be seen that the research hotspots of digital literacy mainly focus on literacy, new literacy, and information.

Table 1. Top 10 keywords Centrality in WoS (sorted by intermediate centrality)

Rank	Keywords	Frequency	Intermediate centrality
1	Literacy	907	1.21
2	New literacy	156	0.74
3	Early adolescence	78	0.71
4	University student	132	0.64
5	To learners	44	0.63
6	Material	96	0.45

7	Information	369	0.4
8	Teaching strategy < strategy	25	0.34
9	Health literacy	272	0.32
10	Instructional strategy	118	0.28

Keyword co-occurrence was done in the CNKI database, the running time of the software was set as "2006-2023", the threshold value was set as K=25, YearPerSlice was set as "1", and the pruning method was Pathfinder, year by year pruning and overall network pruning, and visual analysis was carried out. After running, the co-occurrence map of hot keywords in literature was obtained, as shown in Figure 1. A total of 612 high-frequency keywords were found, forming 883 connections. In Figure 2, the size of nodes and text represent the frequency of keyword occurrence, the lines between nodes represent the connections established in different periods, and the thickness and density of lines represent the intensity of keyword co-occurrence. It can be seen that "digital literacy" is the largest node, followed by "digital economy" and "digital transformation". Judging from the time span calculated from the software, digital literacy, information literacy, e-learning environment, digital inclusion, etc., emerged earlier, and recently, keywords such as teacher digital literacy, generative artificial intelligence, digital transformation of education, digital empowerment, and digital education have emerged, which may become a new direction for the future research of Digital Literacy.

Table 2 shows the intermediary centrality index representing node promotion in CNKI, the communication between digital literacy, digital media literacy, horizon report, etc., and other hot keywords has a strong link. Meanwhile, it can be seen that although the frequency of keywords such as "digital humanities" and "online education" is not high, their intermediary centrality is high, indicating that they are often in the communication path with other keywords. It has a positive effect on the mutual reference relationship between literatures.

From the Centrality value of keywords in CNKI, the Centrality value of digital literacy is the largest (Centrality= 0.51), which is most closely related to other keywords, and the intermediary centrality value of digital media literacy, horizon report, and other keywords is also high (centrality ≥0.28). Combined with the frequency and centrality of keywords, it can be seen that the research focus of digital literacy is mainly on digital literacy, digital media literacy, and digital competence.

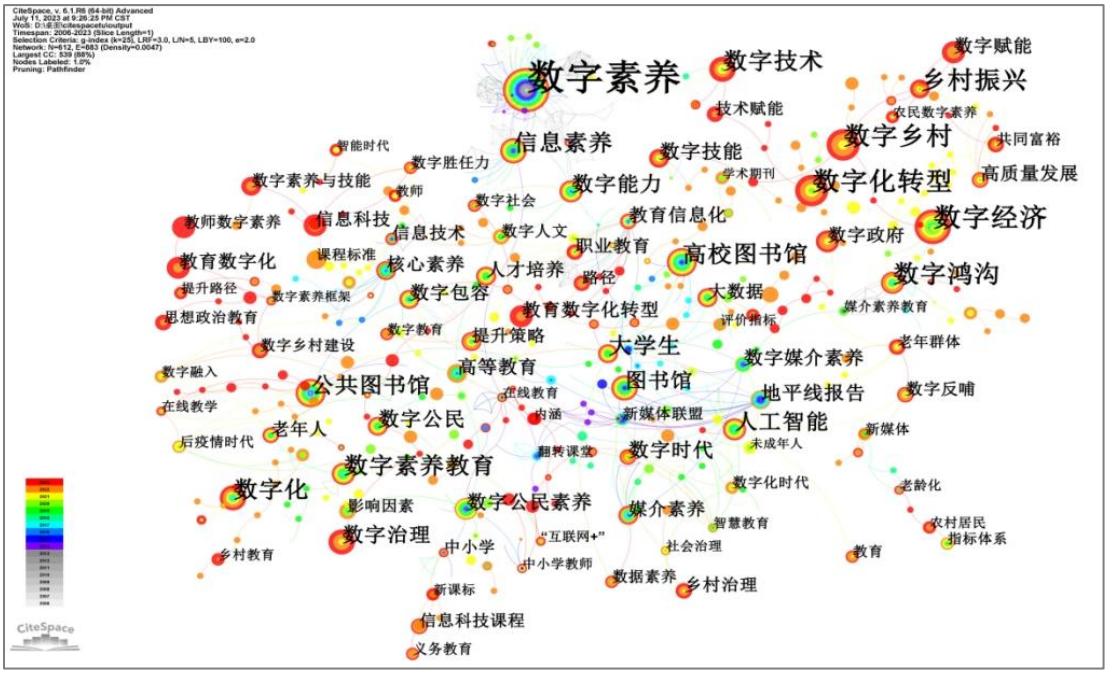

Figure 2. Keyword co-occurrence in CNKI

Table 2. Top 10 keywords Centrality in CNKI (sorted by intermediate centrality)

Rank	Keywords	Frequency	Intermediate centrality
1	数字素养 Digital literacy	681	0.51
2	**数字媒介素养** Digital media literacy	23	0.29
3	**地平**线报告 Horizon report	28	0.28
4	**数字人文** Digital humanities	13	0.26
5	**数字能力** Digital capability	37	0.25
6	**新媒体**联盟 New media alliance	12	0.22
7	**在**线教学 Online education	8	0.22
8	**大学生** College student	50	0.19
9	**数字化**转型 Digital transformation	5	0.19
10	**数字技能** Digital technique	5	0.19

Keyword Clustering Analysis

Keyword clustering analysis is applied to directly reflect the research hotspots of digital literacy in WoS in Figure 3. and CNKI in Figure 4. The color blocks represent the cluster regions.

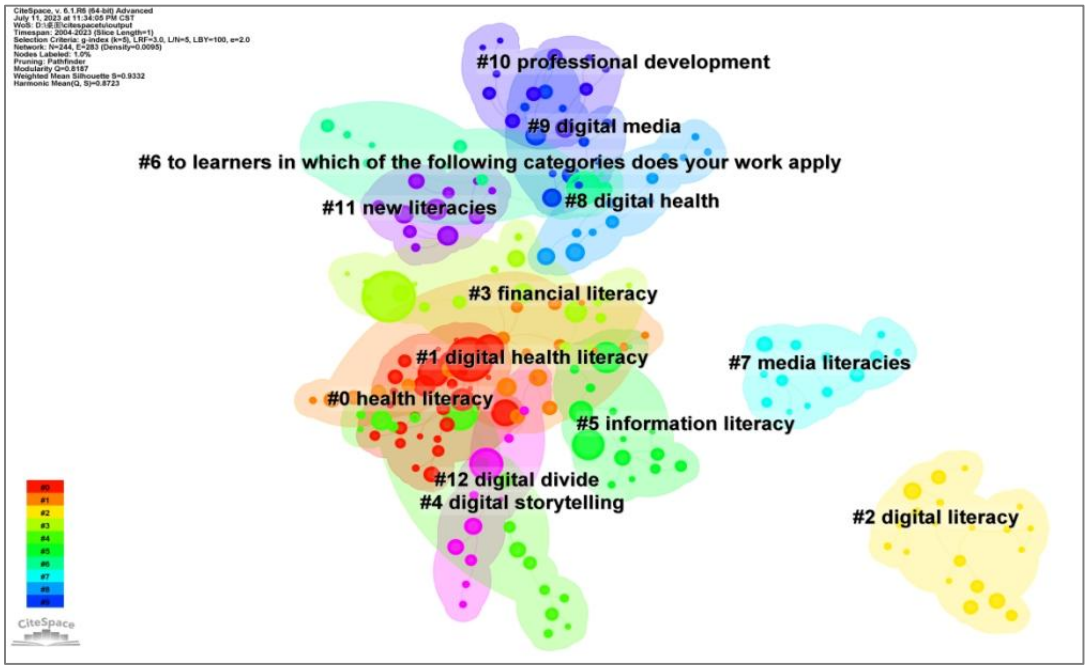

Figure 3. Keywords clustering in WoS

In WoS, node N=244, number of connections E=283, network Density=0.0095. The size of module value Q is related to the density of nodes. The larger the Q value is, the better the clustering effect is, and it can be used for scientific cluster analysis. The size of the average contour value S can be used to measure the homogeneity of the cluster, and the larger the S value is, the higher the homogeneity of the network, indicating that the cluster has high confidence. As can be seen from Figure 3, Q=0.8187 (greater than 0.3), indicating that the network structure has good clustering effect. S=0.9332 (greater than 0.5), high homogeneity, indicating that this cluster view is significant and reasonable, and different clusters are better divided. From the keyword cluster view, They formed #1health literacy, #2digital health literacy, #3digital literacy, #4financial literacy, and #5digital storytelling, #6information literacy, #7Learners learning, #8media literacies, #9digital health, #10digital media, #11professional development, #12new literacis, #13digital divide, a total of 13 clusters, The research on digital literacy mainly focuses on these clusters (see Figure 3 and Table 3), which are represented by "health literacy", "digital health literacy" and "digital literacy". The average years of the top five clusters were from 2010 to 2014, indicating that relevant research matured during this period. The largest cluster is "health literacy" in 2006, which contains 29 keywords, including media literacies, literacy, health information, digital divide, and so on. Overall, the top five clusters mainly focus on digital-related literacy, such as financial literacy, digital storytelling, information literacy, and other topics.

Table 3. The main keywords of clustering in WoS

Rank	Cluster name	Main keywords	Average year	Keyword Quantity
1	health literacy	health literacy (170.16, 1.0E-4); media literacies (73.13, 1.0E-4); literacy (68.48, 1.0E-4); health information (63.78, 1.0E-4); digital divide (51.9, 1.0E-4)	2011	29
2	digital health literacy	digital health literacy (113.41, 1.0E-4); ehealth literacy (86.65, 1.0E-4); media literacies (47.61, 1.0E-4); internet use (41.33, 1.0E-4); serious games (33.77, 1.0E-4)	2013	21
3	digital literacy	digital literacy (129.09, 1.0E-4); instructional strategies (111.31, 1.0E-4); media literacies (99.26, 1.0E-4); methods and materials (91.24, 1.0E-4); digital divide (58.59, 1.0E-4)	2014	20
4	financial literacy	financial literacy (658.26, 1.0E-4); financial literacy (68.54, 1.0E-4); media literacies (63.93, 1.0E-4); digital literacies (59.24, 1.0E-4); web 2.0 (37.62, 1.0E-4)	2010	20
5	digital storytelling	digital storytelling (110.75, 1.0E-4); technology (34.87, 1.0E-4); design (31.29, 1.0E-4); improving classroom teaching (18.91, 1.0E-4); serious game (18.68, 1.0E-4)	2013	16

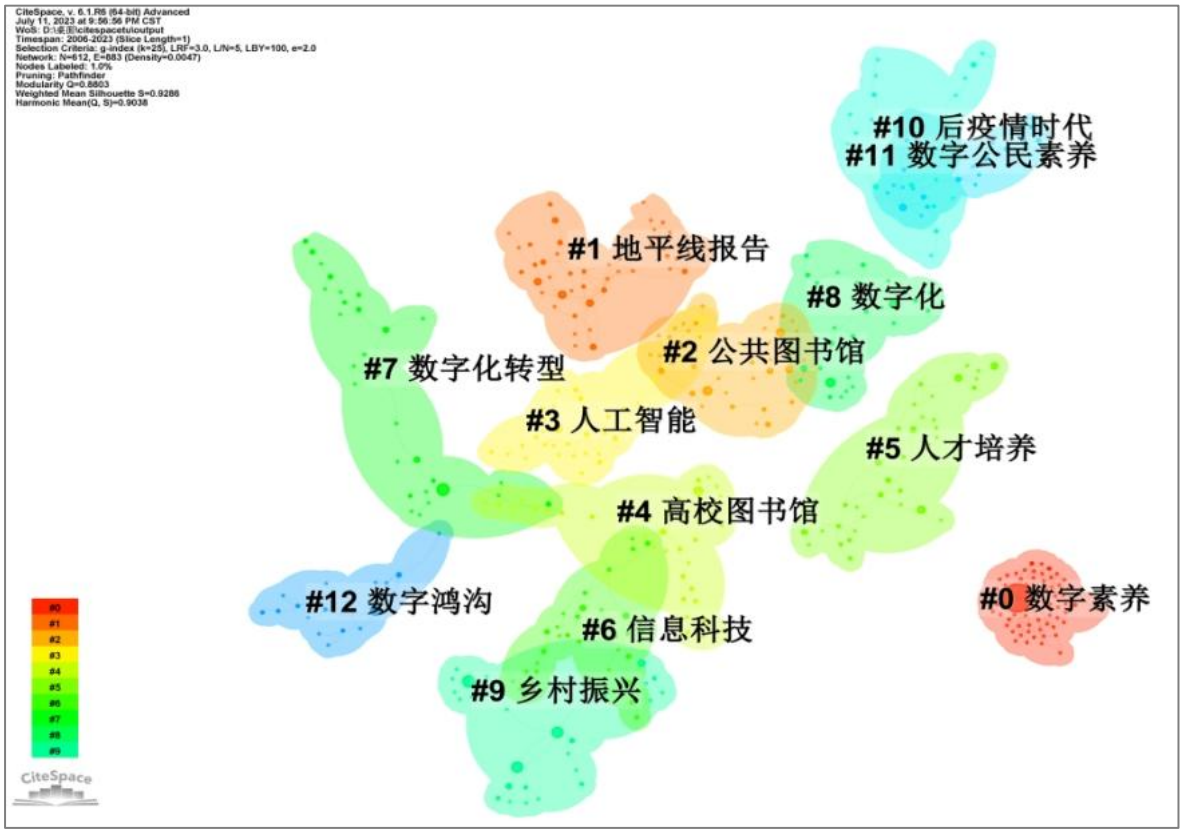

Figure 4. Keywords clustering in CNKI

In CNKI, node N=612, number of connections E=883, network Density=0.0047. As can be seen from Figure 4., Q=0.8803, indicates that the network structure has a good clustering effect; S=0.9286, the homogeneity is high, and different clusters are better divided. Ten clusters are shown, led by "Digital literacy," "Horizon Report," and "Public libraries." The average years of the top five clusters were around 2014-2020, indicating that relevant research matured during this period. The largest cluster is "digital literacy", the year is 2006, and contains a total of 62 keywords, the main keywords are Internet +, teachers and students, network learning environment, etc.

Table 4. The main keywords of clustering in CNKI

Rank	Clustering name	Main keywords	Average year	Keywords quantity
1	数字素养 Digital literacy	Digital literacy (219.69, 1.0E-4); Internet+ (14.05, 0.001); tpack (10.53, 0.005); Teacher and students (10.53, 0.005); Rural residents (9.95, 0.005)	2014	62

2	地平线报告 Horizon report	Horizon report (75.64, 1.0E-4); New media alliance (47.45, 1.0E-4); Higher education (39.17, 1.0E-4); Emerging technologies (31.7, 1.0E-4); Flipped classroom (31.7, 1.0E-4)	2016	48
3	公共图书馆 Public library	Public library (55.86, 1.0E-4); Undergraduates (47.9, 1.0E-4); Digital inclusion (34.81, 1.0E-4); Media literacy (34.81, 1.0E-4); Digital media literacy(24.26, 1.0E-4)	2017	42
4	人工智能 Artificial intelligence (AI)	AI (60.18, 1.0E-4); smart education (17.52, 1.0E-4); Primary and middle school teachers (14.31, 0.001); New education infrastructure(14.31, 0.001); Basic education (14.31, 0.001)	2019	40
5	高校图书馆 University library	University library (35.32, 1.0E-4); Big data (31.17, 1.0E-4);Media convergence (24.51, 1.0E-4); Academic journal (18.93, 1.0E-4); Information literacy education (17.86, 1.0E-4)	2020	39

Timeline Analysis

Frontier trend analysis is to describe the transition and research nature of a certain research field through continuous reference of a fixed set of basic literature clustering, mainly based on co-citation clustering and citations. As one of the main views of CiteSpace, Timeline maps the clustering of literature keywords on a two-dimensional timeline, providing a reference for researchers to explore the evolution process and frontier trend of clustering of a certain topic, as well as the relationship between hot topics. Different color numbers in Figure 5. (WoS) and Figure 6. (CNKI) correspond to different clustering results, and nodes with the same color are important keywords in the same cluster.

In analyzing the WoS database, The top 13 clusters were #1health literacy, #2digital health literacy, #3digital literacy, #4financial literacy, and #5digital storytelling, #6information literacy, #7to learners in which of the following categories does your work apply, #8media literacies, #9digital health, #10digital media, #11professional development, #12new literacis, and #13digital divide, as shown in Figure 5, The largest cluster of relevant literature is "health literacy", which contains 29 keywords, and

the average year is 2011. Major keywords include media literacies, literacy, health information, digital divide, etc. Keywords that emerged over time include financial literacy, digital health, etc. According to the cluster report generated by the system, In this cluster, Hu, J, Wang were the most consistent with the clustering keywords. Yanyu(2022) Influence of students' perceptions of instruction quality on their digital reading performance in 29 OECD countries: A multilevel analysis; related literacy clustering is more active.

The top 13 clusters in the analysis of CNKI are #1 digital literacy, #2 Horizon Report, #3 Public libraries, #4 artificial intelligence, #5 university libraries, #6 talent cultivation, #7 Information technology, #8 digital transformation, #9 digitalization, #10 rural revitalization, #11 post-pandemic era, #12 digital citizenship, #13 digital divide. As can be seen from Figure 3, the largest cluster of relevant literature is "digital literacy", which contains 62 keywords, and the average year is 2014. The main keywords include Internet +, preschool teachers and students, e-learning environment, etc. The keywords that appear with the advance of time include information technology courses, digital empowerment, etc. The cluster report generated by the system shows that, Artificial intelligence, talent training, digital transformation and other clusters are more active.

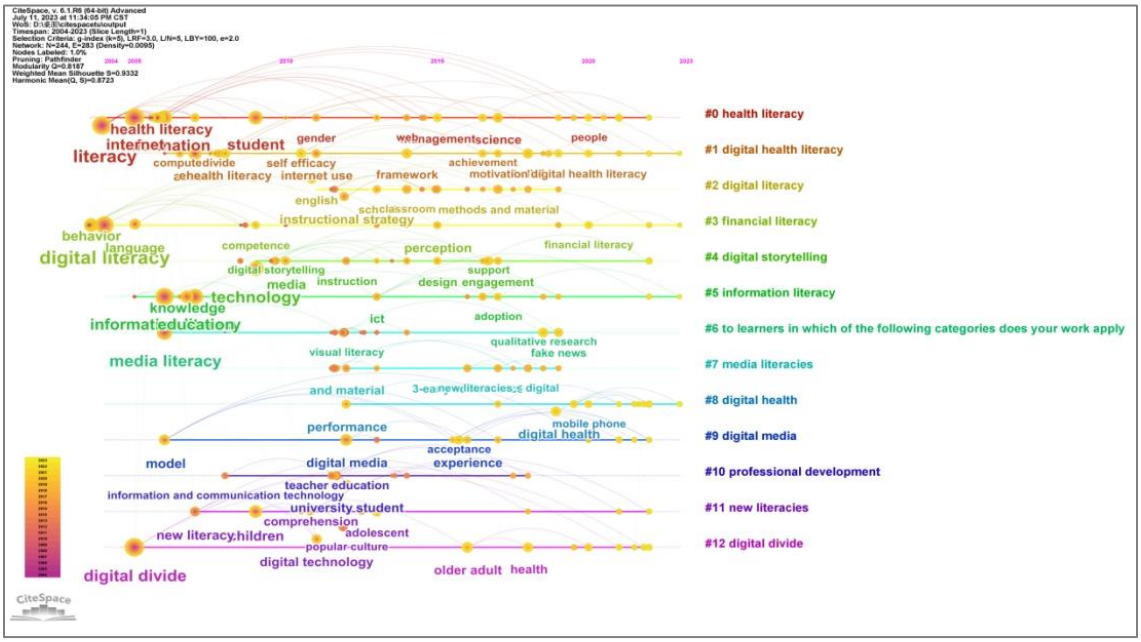

Figure 5. Two-dimensional timeline in WoS

Based on the analysis of the WoS database and the CNKI database, several key findings and conclusions can be drawn: health literacy is the largest and most active cluster in the WoS database, with 29 keywords and an average publication year of 2011. This indicates that health literacy has been a prominent and long-standing research topic. The emergence of new keywords such as financial

literacy and digital health over time suggests that these areas have gained increasing attention in the literature. Researchers Hu and Wang have been consistent contributors to the health literacy cluster, indicating their significant involvement in this field.

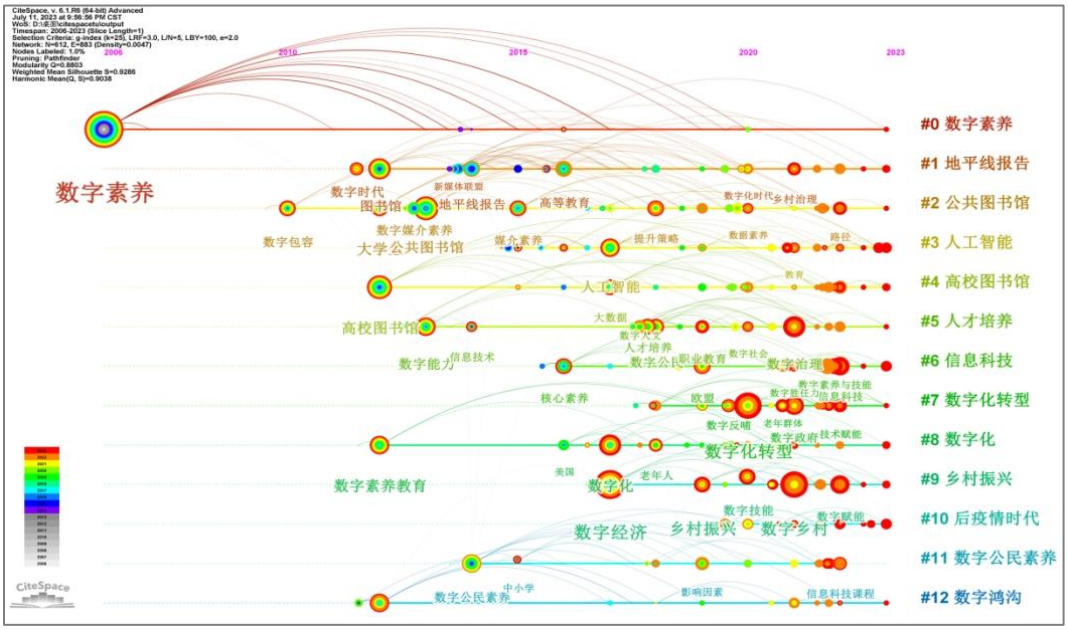

Figure 6. Two-dimensional timeline in CNKI

Digital literacy is the largest and most active cluster in the CNKI database, containing 62 keywords with an average publication year of 2014. This suggests that digital literacy has been a major focus of research in the Chinese academic community in recent years. The appearance of keywords related to information technology courses and digital empowerment over time signifies the evolving interests and developments in the field of digital literacy. Artificial intelligence, talent training, and digital transformation are among the more active clusters in the CNKI database, indicating their growing importance in the Chinese academic landscape.

Health literacy and digital literacy are dominant themes in both databases, reflecting their significance in the research landscape of health and digital-related topics. The emergence of new keywords over time in both databases highlights the evolving nature of research in health and digital literacy, as new areas of interest and concern gain prominence. The CNKI database demonstrates a particular focus on digital literacy, with an emphasis on keywords like Internet +, preschool teachers and students, and e-learning environment, suggesting a strong interest in educational and technology-related aspects of digital literacy in the Chinese academic context. Artificial intelligence, talent training, and digital transformation have emerged as active research clusters in the CNKI database, indicating the growing importance of these topics in the Chinese academic community.

Time zone chart analysis

In order to explore the development and evolution process of research from the time dimension, this paper uses the time zone chart in CiteSpace tool to analyze it. The time zone chart is mainly from the perspective of time and space, and clearly displays the updates of key words and the relationships among documents according to the time sequence in two-dimensional coordinates with time as the horizontal axis, as shown in Figure 7. In the time zone diagram, the node size represents the frequency of the keyword's occurrence, the year of the node represents the time when the keyword first appeared, and the lines between nodes represent the simultaneous occurrence of different keywords in an article, representing the inheritance relationship and evolution process between different periods. Combined with the number of papers over the years, it can especially explore the main focus of research in the hot period, and also explain the period or stage of the field. As can be seen from Figure 7, the largest node of relevant literature is "digital literacy", which was proposed in 2004. In early studies, the high-frequency keywords include literacy, digital literacy, behavior, attitude, etc. The related concepts studied have a long span and a large influence range. Relevant research has continued until now, and subsequent studies have gradually put forward different concepts. The research topic roughly went through three stages. The most recent concepts are new keywords such as digital health literacy, financial literacy, and mobile phone.

It can be seen from Figure 8 that in CKNI database, the largest node of relevant literature is "digital literacy", which was proposed in 2006. In early studies, high-frequency keywords include information literacy, digital inclusion, digital divide, university library, etc. The related concepts studied have a long span and a large influence range. Relevant research has continued until now, and subsequent studies have gradually put forward different concepts. The research topic roughly goes through four stages. The most recent concept is to put forward new keywords such as teachers' digital literacy, digital education, and digital village construction.

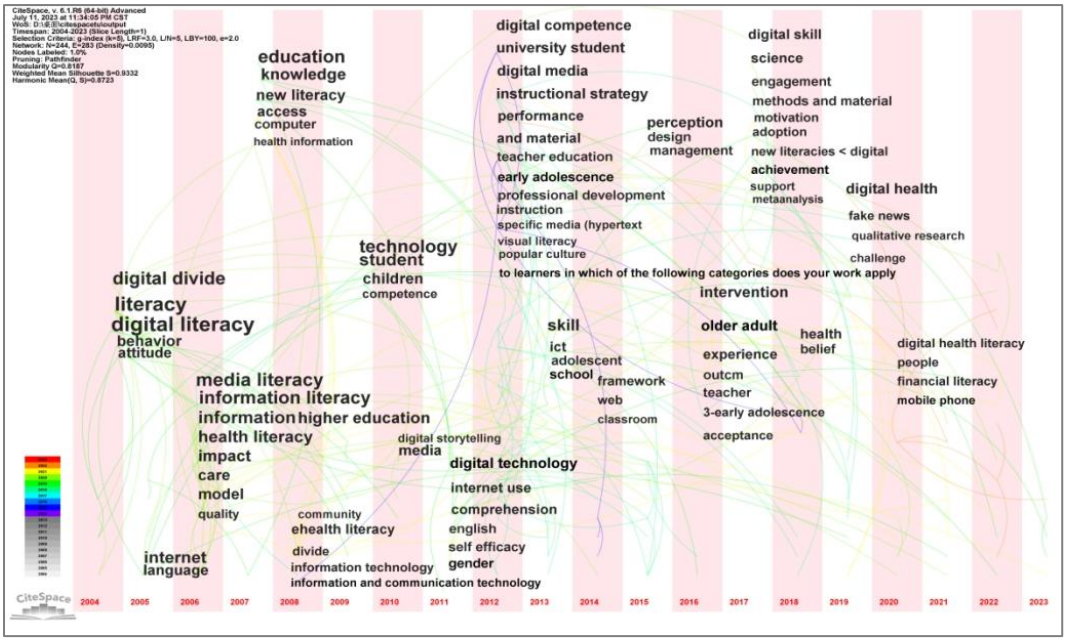

Figure 7. Time zone chart in Wos

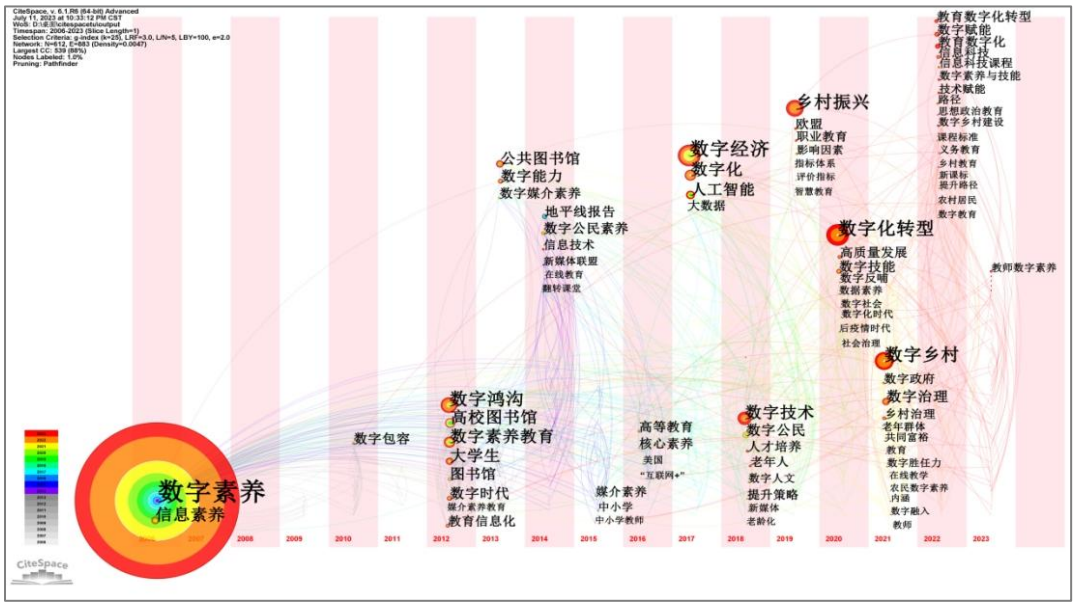

Figure 8. Time zone chart in CNKI

Strongest Citation Bursts

Keyword bursts provide evidence that a particular keyword is associated with a spike in occurrence frequency, and a keyword burst indicates that a potential topic has attracted or is attracting unusual

attention from researchers at a particular time. As a result, emergent detection is considered an indicator of a highly active research field that can explore emerging trends.

Table 5. Top 50 Keywords with the Strongest Citation Bursts in WoS

Keywords	Year	Strength	Begin	End	2004 - 2023
Computer literacy	2004	7.55	2004	2010	
Digital divide	2005	32.09	2005	2016	
Internet	2005	12.01	2005	2011	
Digital library	2005	8.1	2005	2015	
Information literacy	2006	31.65	2006	2014	
New literacy	2007	60.42	2007	2016	
Digital literacy	2004	17.27	2008	2011	
Web 20	2009	11.39	2009	2013	
Collaborative learning	2009	7.65	2009	2016	
Digital storytelling	2010	11.06	2010	2018	
Digital native	2011	7.68	2011	2018	
Early adolescence	2012	42.69	2012	2015	
Learners' Education	2012	27.66	2012	2013	
Media literacy	2006	26.42	2012	2015	
Information and communication technology	2008	25.51	2012	2016	
Popular culture	2012	25.37	2012	2016	
Specific media	2012	20.88	2012	2015	
Visual literacy	2012	19.61	2012	2016	
Theoretical perspective	2012	16.75	2012	2014	
Teaching strategy	2012	15.26	2012	2015	
Critical analysis	2012	14.71	2012	2015	
University student	2012	12.98	2012	2015	
Research methodology	2012	11.88	2012	2014	
Case study	2012	10.34	2012	2015	

Content literacy	2012	10.27	2012	2019	
Critical literacy	2012	10.09	2012	2015	
Instructional technology	2012	7.07	2012	2015	
Text feature	2012	6.53	2012	2015	
Strategy	2013	9.96	2013	2019	
Writing strategy	2013	6.9	2013	2014	
Web use	2014	11.42	2014	2019	
Instruction	2012	11.3	2014	2019	
Blended learning	2014	7.17	2014	2017	
Text	2015	16.64	2015	2018	
ICT literacy	2015	7.14	2015	2017	
Identity	2015	6.16	2015	2017	
Early adolescence	2016	18.07	2016	2020	
Methods and material	2017	21.95	2017	2020	
New digital literacies	2017	17.91	2017	2019	
Classroom	2014	11.04	2017	2020	
computational thinking	2017	8.34	2017	2019	
tool	2017	7.9	2017	2018	
instructional strategy	2012	12.72	2018	2019	
teaching strategy strategy	2018	12.39	2018	2019	
critical analysis digital	2018	11.4	2018	2019	
pedagogy	2010	9.33	2018	2020	
and material	2012	8.02	2018	2019	
reader	2018	7.13	2018	2020	
seeking	2007	6.1	2018	2020	
integration	2019	8.27	2019	2021	
participation	2019	6.33	2019	2020	

In order to have a deeper understanding of the evolution and development trend, this paper obtains emergent words in the research fields of Wos and CNKI. The results are shown in Table 5. (WoS) and

Table 6. (CNKI), including the onset year, duration and intensity of emergent words. On this basis, the research development trend is forecasted from three perspectives: intensity, duration and time of emergence.

In the analysis of WoS, from the perspective of time series, "computer literacy", "digital divide", "digital library", "internet", etc., started at the earliest time and were the hotspots of early research. In addition, from the perspective of breakout duration, "digital divide", "digital library", "new literacy" and "digital storytelling" took a long time to emerge, indicating that they have been the focus of research for quite a long time. According to the emergence intensity of emergent words, it can be found that "new literacy" (Strength=60.42), "early adolescence" (Strength=42.69), "digital divide. "(Strength=32.09)," information literacy "(Strength=31.65) emergence strength is very high, indicating that the frequency of large changes. In general, artificial intelligence, health literacy and mental health not only have a high intensity of emergence, but also have a short time, which can be considered as the latest emerging research hotspots. In general, with the passage of time, the progress of society and the changes of the external environment, the research contents and research hotspots of Digital literacy are constantly changing, which demonstrates from another perspective that Digital literacy is a topic of research value.

Table 6. Top 50 Keywords with the Strongest Citation Bursts in CNKI

Keywords	Year	Strength	Begin	End	2006 - 2023
媒体素养教育 Media literacy education	2012	2.95	2012	2020	
数字媒介素养 Digital media literacy	2013	8.75	2013	2020	
数字素养 Digital library	2013	1.85	2013	2019	
地平线报告 Horizon report	2014	13.62	2014	2018	
新媒体联盟 New media alliance	2014	6.4	2014	2018	
翻转课堂 Flipped classroom	2014	4.68	2014	2017	
数字公民	2014	3.69	2014	2016	

Digital citizenship					
在线教育 Online education	2014	2.46	2014	2015	
幼儿师生 Preschool teachers and students	2014	1.96	2014	2015	
学前教育 Preschool education	2014	1.96	2014	2015	
领导才能 Leadership	2014	1.55	2014	2020	
创客空间 Makerspace	2015	3.03	2015	2017	
媒介素养 Media literacy	2015	2.75	2015	2018	
个性化学习 Personalized learning	2015	2.47	2015	2019	
中小学教师 Primary and secondary school teachers	2015	1.7	2015	2016	
图书馆 Library	2012	1.69	2015	2016	
学习者 Learners	2015	1.66	2015	2018	
信息技术教育 Information technology education	2015	1.66	2015	2018	
高等教育 Higher education	2016	5.59	2016	2019	
美国 USA	2016	5.14	2016	2019	
核心素养 Core literacy	2016	4.55	2016	2019	
教育信息化	2012	4.05	2016	2017	

Educational informatization					
新兴技术 Emerging technology	2016	3.75	2016	2017	
深度学习 Deep learning	2016	2.5	2016	2017	
大学图书馆 University library	2012	8.23	2017	2020	
人工智能 Artificial intelligence	2017	4.52	2017	2019	
数**字素养教育** Digital literacy education	2012	3.89	2017	2021	
艺术教育 Art education	2017	2.17	2017	2019	
青少年 Teenager	2017	1.65	2017	2021	
数字市民 Digital citizen	2018	5.62	2018	2021	
大学生 College student	2012	2.07	2018	2019	
网络安全 Network security	2018	1.85	2018	2021	
中学生 Middle school student	2018	1.48	2018	2021	
策略 Tactics	2018	1.48	2018	2021	
影响因素 Influencing factor	2019	3.7	2019	2020	
智慧教育 Wisdom education	2019	2.33	2019	2020	
大数据 Big data	2017	2.29	2019	2020	
STEM**教育**	2019	2.2	2019	2020	

stem education					
终身学习 Lifelong learning	2019	2.11	2019	2021	
指标体系 Index system	2019	1.72	2019	2021	
数字经济 Digital economy	2017	5.69	2020	2021	
未成年人 Minor	2020	3.37	2020	2021	
疫情后时代 Post-pandemic era	2020	2.95	2020	2021	
澳大利亚 Australia	2020	2.41	2020	2021	
社会治理 Social governance	2020	1.77	2020	2021	
数字时代 Digital age	2020	1.65	2020	2023	
数字时代 Digital government	2021	2.22	2021	2023	
数字融合 Digital integration	2021	2	2021	2023	
网络素养 Network literacy	2021	1.5	2021	2023	
混合式教学 Blended teaching	2021	1.5	2021	2023	

Table 6. shows the emergent words in the research field of digital literacy in the past 17 years. There are 50 emergent words in this table. From the perspective of time series, "media literacy education", "digital media literacy" and "digital library" started the earliest. In addition, the emergence duration of "media literacy education", "digital media literacy", "leadership" and "digital library" is relatively long, indicating that they have been the focus of relevant research for quite a long period of time. According to the emergence Strength of emergent words, it can be found that the emergence Strength of "Horizon

report" (Strength= 13.62), "digital media literacy" (trength=8.75), "university library" (strength =8.23), "new media alliance" (Strength=6.4) and other emergent words are very high. Explain the occurrence of large changes in frequency. In summary, "digital government", "network literacy" and "blended teaching" are not only emerging with high intensity, but also within a short time, which can be considered as the latest emerging research hotspots.

Country and regional distribution analysis

In this part, the node type of Cite Space is set to Country, that is, the distribution of the studied countries is analyzed, and the visual view spectrum of the cooperation network among countries/regions can be obtained, as shown in Figure 9. The size of the nodes represents the number of published papers in the country, the lines between nodes represent the cooperation between different countries, and the thickness of the lines represents the closeness of cooperation. As shown in Figure 9, there are 109 nodes and 172 connections, and the overall network density is 0.0292, indicating that there are a large number of countries studying digital literacy and close cooperation among them. Among them, the United States is the largest research country, followed by the United Kingdom and Australia, and the cooperation network among various countries is relatively close.

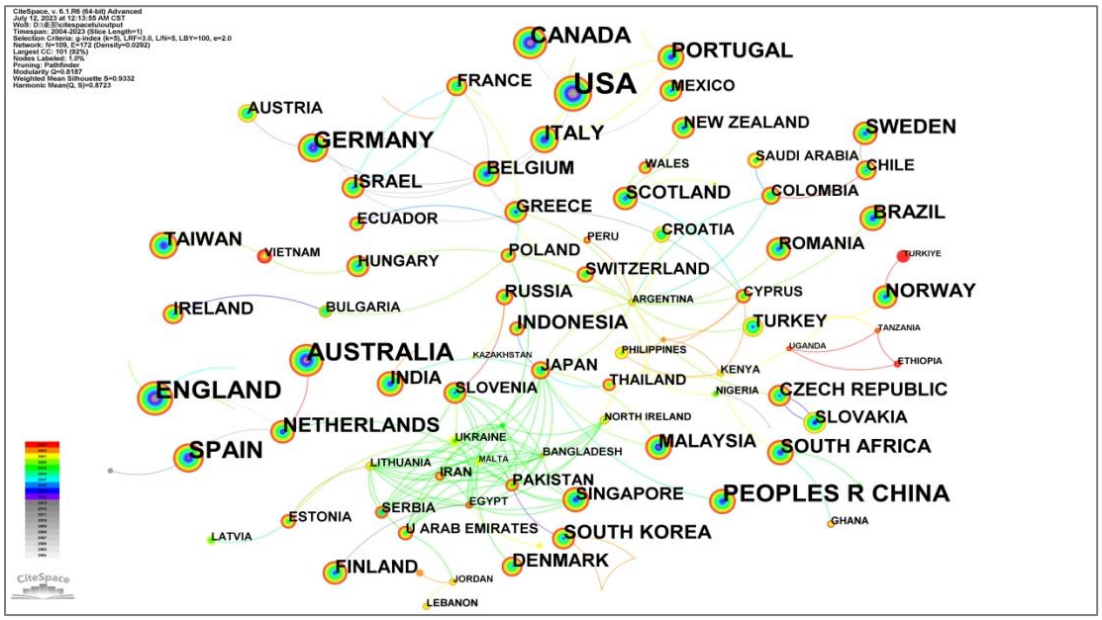

Figure 9. Countries and cooperative networks

Through the statistics of the number of publications in different countries, the top ten high-producing countries can be obtained in Table 7. From the perspective of centrality, the number of papers published in most countries shows a certain positive correlation with centrality, but the centrality of Australia,

China and Canada is obviously not proportional, indicating that although the number of papers published is high, the centrality is low, and the cooperative relationship with other countries is not ideal, and there may be problems in the reference of literature, which needs to be strengthened in the future.

Table 7. Top 10 most productive countries

Rank	Country	Number of published papers	Centrality	Starting year
1	USA	1973	0.07	2004
2	ENGLAND	663	0.1	2004
3	AUSTRALIA	592	0	2005
4	SPAIN	496	0.03	2005
5	CHINA	419	0	2006
6	GERMANY	380	0.03	2005
7	CANADA	351	0	2004
8	PORTUGAL	197	0.03	2010
9	ITALY	186	0.2	2004
10	NETHERLANDS	178	0.23	2005

Characteristics of the Research Community and Published Research on Digital Literacy

The analysis of the Web of Science (WoS) and China National Knowledge Internet (CNKI) databases reveals distinct characteristics within the research community and published works on digital literacy. Internationally, the research community is diverse and multidisciplinary, involving educators, technologists, and policymakers who focus on practical applications and empirical studies. In China, the research community is more centralized, with a strong emphasis on theoretical exploration and policy-oriented research. This difference highlights the varying priorities and approaches to digital literacy across different regions.

Commonly Studied Aspects of Digital Literacy Internationally and in China

The study identifies several key thematic areas commonly explored in digital literacy research. Internationally, the most commonly studied aspects include digital competencies, media literacy, and the practical applications of digital technologies in education and various professional fields. Research often focuses on how digital literacy impacts learning outcomes, employability, and societal participation. In contrast, Chinese research predominantly delves into the conceptual frameworks of digital literacy, theoretical underpinnings, and interdisciplinary approaches. Topics such as the

integration of digital literacy into the curriculum and the role of digital literacy in cultural and social contexts are frequently examined.

Distinctions in Digital Literacy Between China and the Rest of the World

Significant distinctions exist in how digital literacy is perceived and approached between China and the rest of the world. International research tends to be more pragmatic, with a focus on developing practical skills and competencies that can be directly applied in various contexts. Chinese research, however, is more focused on theoretical and conceptual analyses, aiming to build comprehensive frameworks that can guide policy and educational strategies. This divergence reflects different educational philosophies and priorities, with international efforts geared towards immediate applicability and Chinese efforts towards long-term theoretical development.

Visualization and Analysis of Web of Science and CNKI Databases

Using CiteSpace to visualize and analyze the two largest databases, Web of Science (WoS) and CNKI, the study provides insights into the developmental trajectory of digital literacy research. The visualizations depict the evolution of key themes and highlight the most influential publications and authors in the field. Emerging trends such as digital ethics, misinformation, and data privacy are prominently featured in recent studies. The analysis identifies research gaps, particularly in the Chinese context, where there is a need for more empirical studies and comprehensive curricula that address these emerging issues. These gaps underscore the necessity for adapting digital literacy education to meet the changing demands of the digital age.

Identified Research Gaps in the Field of Digital Literacy

The study highlights several research gaps that need to be addressed to advance the field of digital literacy. In China, there is a pressing need for empirical research that evaluates the effectiveness of digital literacy programs and initiatives. Additionally, there is a lack of comprehensive curricula that incorporate emerging topics such as digital ethics, misinformation, and data privacy. Internationally, while practical applications are well-covered, there is room for more theoretical exploration to create a balanced approach to digital literacy education. Addressing these gaps will require a concerted effort from educators, researchers, and policymakers to develop robust educational frameworks that are both theoretically sound and practically relevant.

DISCUSSION

Visualization and Analysis of Web of Science and CNKI Databases

The use of CiteSpace to visualize and analyze the Web of Science (WoS) and China National Knowledge Internet (CNKI) databases provides a clear picture of the developmental trajectory of digital literacy research. Visualizations indicate that while both databases reflect a growing interest in digital literacy, the thematic focuses differ. Over time, both databases show the emergence of new keywords and clusters, indicating the evolving nature of research in health and digital literacy. In the WoS database, keywords like financial literacy and digital health have gained increasing attention, while the CNKI database has seen interests in areas such as information technology courses and digital empowerment.

The time zone chart in the WoS database suggests that the research topic roughly went through three stages. However, in the CNKI database, the time zone chart indicates that the research topic roughly goes through four stages. This difference might be attributed to variations in the academic and research landscape between the international and Chinese contexts.

Characteristics of the Research Community and Published Research on Digital Literacy

The study reveals that the research community on digital literacy is distinctively characterized by its regional focuses. Internationally, the community is multidisciplinary, involving educators, technologists, and policymakers who emphasize empirical studies and practical applications. This diverse involvement reflects a pragmatic approach aimed at equipping learners with immediate, applicable digital skills. In contrast, the Chinese research community is more centralized and theoretical, often aligned with policy-oriented goals. This focus indicates a strategic, long-term approach to integrating digital literacy into the broader educational and social frameworks. Comparing Figure 1. and Figure 2., in both WoS and CNKI, digital literacy is the largest node. In WoS, digital literacy, literacy, digital divide, internet, and information literacy appeared earlier. Keywords such as telemedicine, public health, mental health, digital health literacy, financial literacy, and mobile phone have emerged more recently. In the analysis of CNKI, digital literacy, information literacy, e-learning environment, and digital inclusion appeared earlier, and teacher digital literacy, generative artificial intelligence, digital transformation of education, digital empowerment, and digital education have been shown in recent publications. WoS shifted its focus from strategic research on digital literacy to more specific literacy, such as health and financial literacy, while CNKI shifted its focus from digital

competence to digital society transformation, digital education, and more on education. China still focuses on education-oriented toward the topic.

Commonly Studied Aspects of Digital Literacy Internationally and in China

Figure 3. and Figure 4. exhibit the clustering analysis of digital literacy in both WoS (Web of Science) and CNKI (China National Knowledge Infrastructure) databases. In the context of WoS, the pertinent literatures demonstrate a high level of confidence. Notably, digital health literacy exhibits the highest significance, indicating the international focus on incorporating health aspects into digital literacy, encompassing both mental and physical health considerations. On the other hand, in Table 4, the research from China manifests several prominent clusters, namely digital literacy, digital transformation, and talent cultivation, with a predominant emphasis on education and the popularization of digital literacy.

In the course of the research, it is evident that the emphasis of Chinese digital literacy studies lies predominantly within the realms of education, technological utilization, and classroom instruction. Structurally, the research tends to lean towards analyzing existing frameworks from Western countries, while its own framework design remains insufficiently comprehensive. Therefore, the research direction should be more all-encompassing, delving into the psychological, cognitive, behavioral, and utilization aspects of users to analyze the mechanisms of digital literacy formation. It is imperative to explore the various variables that contribute to distinct individuals' willingness to employ digital literacy and ascertain whether these variables can be influenced through environmental factors and educational interventions to foster digital literacy development. In the context of digital literacy research in China, a distinctive aspect lies in its focus on rural revitalization and integration with policy considerations. However, certain inadequacies become apparent. Although the research highlights the necessity of digital literacy, it falls short in adequately addressing the underlying research motivations, psychological aspects, and the investigation of usage intentions. Furthermore, there is a dearth of exploration concerning the adoption and dissemination of digital literacy at a deeper level.

Distinctions in Digital Literacy Between China and the Rest of the World

The comparative analysis elucidates significant distinctions in the approach to digital literacy between China and other parts of the world. International research is largely pragmatic, concentrating on the acquisition of practical digital skills that can be directly applied in various contexts. This approach is aligned with the immediate needs of learners to function effectively in a digitalized world. Conversely, Chinese research is deeply theoretical, aiming to construct comprehensive frameworks that inform

policy and educational strategies. This divergence highlights different educational priorities, with international efforts focusing on immediate applicability and Chinese efforts on long-term theoretical and structural development.

Identified Research Gaps in the Field of Digital Literacy

The existing literature on digital literacy in China is abundant, with numerous articles published internationally as well. However, an analysis of international collaborations reveals that while there is a substantial volume of publications, there appears to be a deficiency in establishing connections and engaging in international cooperation with other countries (Fig. 9 & Table.7), this observation points to an area worthy of further exploration and investigation in future research endeavors.

The study identifies several critical research gaps that need addressing to advance the field of digital literacy. In China, there is a notable lack of empirical research assessing the effectiveness of digital literacy programs. Additionally, comprehensive curricula that incorporate emerging issues like digital ethics, misinformation, and data privacy are insufficient. Internationally, while practical applications are well-researched, there is a need for deeper theoretical exploration to create a more balanced digital literacy education framework. Addressing these gaps will require collaborative efforts to develop educational strategies that are both practically relevant and theoretically robust.

CONCLUSION

Digital literacy has become a significant issue with the development of digital advancement. Digital literacy definitions have shifted from ICT technological aspect to more detailed and wider perspectives which are deeply embedded in our learning, working, living, and communicating. (Glister, 1997; Tabusum et al. 2014; Walton 2016; JISC 2017; Law et al. 2018). As UNESCO (2018) defined, digital literacy is the ability to access, manage, understand, integrate, communicate, evaluate, and create information safely and appropriately through digital technologies for employment, decent jobs, and entrepreneurship. Frameworks have been published by different organizations and regions. With the development of rapid technological advancement, frameworks and definitions have been introduced enabling citizens to better acquire knowledge and be empowered online. (e.g., 21st-century skills, digital skills, digital competence, digital literacy). Research in digital literacy has shifted from a technical orientation toward a wider perspective (Claro et al., 2012). Although there are many research attempts investigating digital literacy, the interrelations of this concept to cognitive and metacognitive aspects are still blurred (Demirbag & Bahcivan, 2021). Sometimes other terms are used synonymous with digital literacy, such as computer literacy, information literacy, or computer and

information literacy. In the related literature, and in some other studies, digital literacy is used as an umbrella term embracing all of these terms.

Digital literacy has evolved beyond the traditional concept of 'know-how' associated with the functional use of technology. Recent studies have transformed digital literacy into a multidimensional concept. Unlike its previous focus solely on hardware and software-related literacy, it now encompasses cognitive, social, and critical aspects. Barak (2018) defines digital literacy as the amalgamation of competencies necessary to effectively utilize digital technologies in various domains, such as social, cultural, educational, and economic spheres. Furthermore, it involves the ability to evaluate information and its sources, be aware of the risks associated with the digital world, and adapt to the demands of the digital era.

The findings of this research underscore the indispensability of digital literacy as a vital skill in navigating the digital era. The integration of digital literacy into education and public policy is crucial for meeting the information needs of individuals, societies, and professionals. By promoting digital literacy strategies for social development, nations can pave the way for a more informed and empowered global community, to highlight the significance of digital literacy in the digital era a new pathway towards informed and empowered societies. However, to achieve this vision fully, addressing the existing challenges surrounding digital literacy education is imperative and far from enough. Furthermore, the investigation of motivations for adopting digital literacy in diverse demographic groups is identified as a critical step towards advancing digital literacy initiatives. Fostering digital literacy within the educational framework becomes indispensable to empower individuals with the cognitive and ethical tools necessary for informed decision-making and meaningful participation in the digital age.

One of the key implications of this study is the need to bridge the gap between practical and theoretical approaches to digital literacy. Educators and policymakers should consider integrating the strengths of both perspectives to create a more holistic educational framework. This integration can enhance the relevance and effectiveness of digital literacy education, preparing learners not only to use digital tools effectively but also to understand the broader implications of digital technology in society. In the corpus of research articles in the field of digital literacy in China does not exhibit a proportional relationship between publication volume and international influence. This observation underscores the necessity of enhancing scholarly communication and fostering collaborative research endeavors on an international scale, there is a call for cooperative education community.

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