



Rethinking Future Skills Education through Traditional Games: A Systematic Review and Bibliometric Mapping

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ABSTRACT

Introduction. The increasing demand for future skills in the 21st century has led to a growing emphasis on technology-driven learning approaches. However, traditional games have been empirically proven to enhance essential competencies such as collaboration, communication, critical thinking, and creativity. Despite this evidence, their role remains underexplored in the global research landscape.

This study aims to examine the extent to which traditional games are represented in the discourse on future skills and to identify potential gaps within the literature.

Methods. Employs a systematic review integrated with bibliometric mapping to analyze 180 publications indexed in Scopus (2000-2025) to address: 1) identify leading countries, affiliations, and authors; 2) examine influential sources and citation patterns; 3) explore thematic clusters and keyword co-occurrence; and 4) highlight research gaps. Data were processed using VOSviewer for network visualization, while the systematic review adhered to PRISMA guidelines to ensure methodological rigor and depth.

Results. The findings reveal a dominant techno-centric paradigm in future skills research, as evidenced by the prominence of keywords such as gamification, virtual reality, and artificial intelligence in the co-occurrence network. The technological orientation studies are reinforced by the geographical distribution of research, where countries from the Global North (the United States, the United Kingdom, and Italy) emerge as leading contributors in terms of publication volume and collaboration networks. Moreover, the absence of a central cluster in the source and organizational networks suggests fragmented knowledge production and the lack of a unified epistemic core. This indicates that the field, while expanding, has not yet reached conceptual maturity. Notably, traditional games are significantly underrepresented in the keyword network, despite extensive empirical evidence demonstrating their effectiveness in fostering collaboration, communication, critical thinking, and creativity. This reveals a critical misalignment between empirically validated learning practices and the dominant research discourse, which continues to prioritize technology-driven approaches.

Conclusion. The findings demonstrate a structurally imbalanced and techno-centric future skills discourse that overlooks culturally embedded learning practices such as traditional games. This study calls for a paradigm shift toward a more inclusive and human-centered understanding of future skills.

Implication. The need to broaden the conceptualization of future skills beyond technology-driven approaches by integrating culturally grounded learning practices, particularly traditional games, into educational research and policy.

KEYWORDS

future skills, traditional games, bibliometrics

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INTRODUCTION

International educational agendas increasingly emphasize the importance of preparing learners for the challenges of the twenty-first century through inclusive, human-centered, and future-oriented education. Global frameworks such as the United Nations Sustainable Development Goals 4 (SDG 4), UNESCO's Future of Education initiative, and the OECD Learning Compass 2030 highlight the need for educational systems to foster essential competencies including collaboration, creativity, communication, critical thinking, and social responsibility [1]. In this context, future skills are viewed not only as workforce competencies but also as fundamental capacities that enable individuals to adapt to social transformation, global uncertainty, and rapid technological change.

In response to these demands, contemporary educational discourse has increasingly focused on technology-driven pedagogical approaches. Innovations such as virtual reality, gamification, artificial intelligence, simulation-based learning, and digital games-based learning are widely promoted as effective strategies for developing future skills [2]. Previous studies have shown that technology-enhanced learning environments can improve learner engagement, problem-solving abilities, and interactive learning experiences [3]. Consequently, future skills education is often associated with digital-mediated learning environments that prioritize technological innovation and computational learning practice.

However, the growing dominance of techno-centric educational approaches has also raised important pedagogical concerns. The strong emphasis on digital technologies risks narrowing the understanding of future skills into technologically mediated competencies while overlooking culturally grounded, socially interactive, and experientially formed learning [4]. From a sociocultural perspective, learning is fundamentally shaped through participation, interaction, and collaboration within meaningful cultural contexts [5]. Therefore, future skills development should not rely solely on technological advancement but also consider human-centered pedagogical approaches that support meaningful social engagement and contextual learning experiences [6].

Within this context, there is a growing need to reconsider alternative pedagogical approaches that are culturally grounded, socially interactive, and experientially meaningful [7]. One such approach is the use of traditional games as learning media and pedagogical practices. Unlike many technology-driven instructional models, traditional games provide embodied and community-based learning experiences that naturally encourage participation, collaboration, communication, creativity, and problem-solving. As culturally embedded forms of learning, traditional games offer significant potential to support future skills education while simultaneously preserving local wisdom and social values [8].

Traditional games, deeply rooted in cultural heritage, offer significant potential for developing future skills essential for the 21st century. These games not only preserve cultural values but also foster a range of cognitive, social, and motor skills that align with modern educational and career demands. Research highlights that traditional games enhance critical thinking, problem-solving, collaboration, and creativity, which are key components of the future skills framework [9]. Participation in traditional games has been shown to improve motor skills, coordination, and physical fitness, which are foundational for overall development and athletic performance [10]. Additionally, these games promote social skills such as teamwork, communication, and personal responsibility, which are crucial for interpersonal relationships and professional environments [11]. It also transmits cultural values like respect, cooperation, honesty, and community cohesion naturally [12].

Integrating traditional games into educational frameworks, such as the Joyful Problem-Based Learning (J-PBL) model, has demonstrated significant improvements in students' higher-order thinking skills and academic performance. By embedding traditional games into structured learning activities, students experience increased engagement, motivation, and collaboration, leading to better learning outcomes [13]. Moreover, Traditional games promote inclusion, especially for children with special needs [14].

The cultural and educational value of traditional games also extends to language development, rule-following, and cultural transmission, making them a versatile tool for holistic development. These findings suggest that traditional games can serve as a culturally relevant and effective medium for equipping learners with the skills needed to navigate future challenges.

In conclusion, traditional games are not merely recreational activities but powerful tools for developing future skills. Their integration into educational and extracurricular programs can provide a balanced approach to preserving cultural heritage while preparing individuals for the demands of a rapidly evolving world.

This research provides information to: 1) identify leading countries, affiliations, and authors; 2) examine influential sources and citation patterns; 3) explore thematic clusters and keyword co-occurrence; and 4) highlight research gaps. Our proposed research questions are mentioned as follows:

RQ 1: What are the publication trends, most productive countries, and leading institutional affiliations in these research fields?

RQ 2: What are the scholars' profiles and the titles of future skills through traditional games publications?

RQ 3: What are the main themes and findings discussed in the most influential publications on future skills through traditional games?

RQ 4: What are the prevailing keyword trends, and how do they reflect the intellectual structure of the field?

Therefore, this study not only maps the research landscape of future skills but also develops a conceptual framework of cognitive sustainability to address the identified imbalance.

THEORITICAL BACKGROUND

The study explores the intersection of traditional games and the development of future skills, emphasizing their educational and cultural significance. The concept of future skills, often referred to as 21st-century skills, includes critical thinking, problem solving, collaboration, creativity, and adaptability, competencies that are essential to navigate uncertainty and solve complex problems, and for thriving in an era characterized by rapid technological advancement, globalization, and socio-economic transformation [15]. These competencies are increasingly recognized not only as individual capabilities but also as social and contextual capacities that enable individuals to navigate complexity and uncertainty [1].

However, despite this multidimensional framing, the operationalization of future skills in both research and practice has been increasingly dominated by a techno-centric orientation. A substantial body of literature positions digital technologies, such as artificial intelligence, virtual reality, and gamification, as primary vehicles for developing these competencies [16]. While these approaches offer innovative and scalable solutions, they also risk reducing future skills into technologically mediated constructs, implicitly assuming that technological advancement is the primary pathway to future readiness. However, this techno-centric orientation risks reducing future skills into technologically mediated constructs, neglecting the socio-cultural and experiential dimensions of learning. This tendency reflects a form of technological determinism in education, where the development of human competencies is disproportionately linked to digital innovation [17]. Such a perspective may inadvertently marginalize alternative learning pathways that are socially embedded, culturally meaningful, and experientially grounded.

On sociocultural perspective, learning is fundamentally a social process shaped by interaction, participation, and cultural context [18; 19]. Learning, knowledge and skills are not merely acquired individually but are co-constructed through engagement with others within meaningful activities. This perspective highlights the importance of situated learning environments where individuals actively participate in culturally relevant practices. In this regard, future skills, particularly collaboration, communication, and creativity, are inherently social and cannot be fully developed through isolated or technology-mediated experiences alone. Instead, they have authentic interaction, shaped problem-solving, and collective meaning-making processes.

Within this framework, traditional games represent a form of indigenous knowledge that integrates cognitive, social, emotional, and cultural dimensions of learning, and experientially grounded learning that aligns closely with sociocultural and constructivist principles. Far from being merely recreational

activities, traditional games function as informal learning systems that facilitate the development of essential competencies through direct engagement and interaction. Serious games and traditional games alike have been identified as effective in fostering these skills. For instance, traditional games like Engklek (Indonesian traditional games) have been adapted into pedagogical models to enhance critical thinking, problem-solving, and collaboration among students [20]. The design of games, whether traditional or digital, often incorporates elements like interactivity and clear goals, which are instrumental in developing future skills [21]. Moreover, traditional games provide experiential and embodied learning experiences, where participants learn through action, reflection, and social negotiation. This aligns with constructivist and experiential learning theories, which emphasize the importance of active participation in knowledge construction.

Comparatively, while digital games are widely recognized for their role in developing future skills such as strategic thinking and ICT competencies [22], traditional games offer a culturally grounded alternative that emphasizes social interaction and physical activity [23]. Traditional games uniquely contribute to cultural preservation and the development of kinesthetic and social intelligence, which are less emphasized in digital gaming environments. This highlights their potential not only as learning tools but also as mechanisms for sustaining cultural identity in the face of globalization.

In the era of modern education, where digital technologies are increasingly integrated into learning processes, traditional games play a crucial role in balancing technological advancement with cultural preservation. Studies have shown that these games can significantly enhance academic performance and general skill development when integrated into formal education, foster higher-order thinking skills, and improve overall learning outcomes [24]. However, despite their demonstrated potential, research on the precise impacts of traditional games on future skills development remains limited and fragmented. Most studies focus on specific skills or contexts, leaving room for a more comprehensive understanding of their broader implications. Bibliometric mapping and systematic reviews, as proposed in this study, can provide valuable insights into the global trends, gaps, and opportunities in this field. Existing studies tend to focus on specific skills or localized contexts, leaving a significant gap in understanding their broader impact within the global educational landscape.

This gap underscores the urgency of conducting a systematic and bibliometric analysis to map the current state of research, identify dominant trends, and uncover overlooked areas. By doing so, this study not only contributes to bridging the gap between empirical evidence and research discourse but also seeks to reposition traditional games as a legitimate and culturally grounded pathway for developing future skills.

RESEARCH METHODS

This research used a systematic review integrated with bibliometric mapping to analyze publications indexed in Scopus (2000-2025). Bibliometrics is used to assess the quality of research, identify research gaps, and set the research agenda [25; 26]. Several Bibliometric techniques are employed to address the research question, encompassing descriptive statistics, co-author analysis, co-citation analysis, co-occurrence analysis, and scientific mapping [27].

1. Design

Using an SLR with the PRISMA protocol. SLR helps to organise scattered research findings into a coherent narrative, identifying patterns, gaps, and areas of consensus within the literature [28]. The use of the PRISMA protocol provided substantial benefits, including improved reporting quality, facilitated critical appraisal, supported evidence-based decision-making, and ensured adaptability through specialized extensions. The details of using the PRISMA protocol are shown in Figure 1, following the procedures systematically.

2. Data and Source

The data were collected in all time frames, from 2020 to 2025 from the Scopus database. The use of the Scopus database is significant for its comprehensive coverage, rigorous quality assurance, and advanced search capabilities. To achieve the objective, the analysis formulated a search strategy in the keywords, abstract, and title (TITLE-ABS-KEY ("future skills") AND TITLE-ABS-KEY ("education") AND TITLE-ABS-KEY ("traditional games") AND PUBYEAR >1999 AND PUBYEAR <2026).

3. Selection Process

The initial identification produced 243 documents spanning from 1982 to 2026. Furthermore, the publication years have been narrowed down to 2000 to 2025, and a total of 220 documents were identified. During the process, the analysis excluded review (n=15), book chapters (n=6), books (n=1), erratum (1), and Non-English papers (n=18) were also excluded, which were written in Spanish, Chinese, Azerbaijani, Lithuanian, Turkish, and Ukrainian. As a result of this selection process, a total of 180 documents were identified as eligible and relevant to the discussion of future skills and traditional games. The details of the selection process were shown in Figure 1.

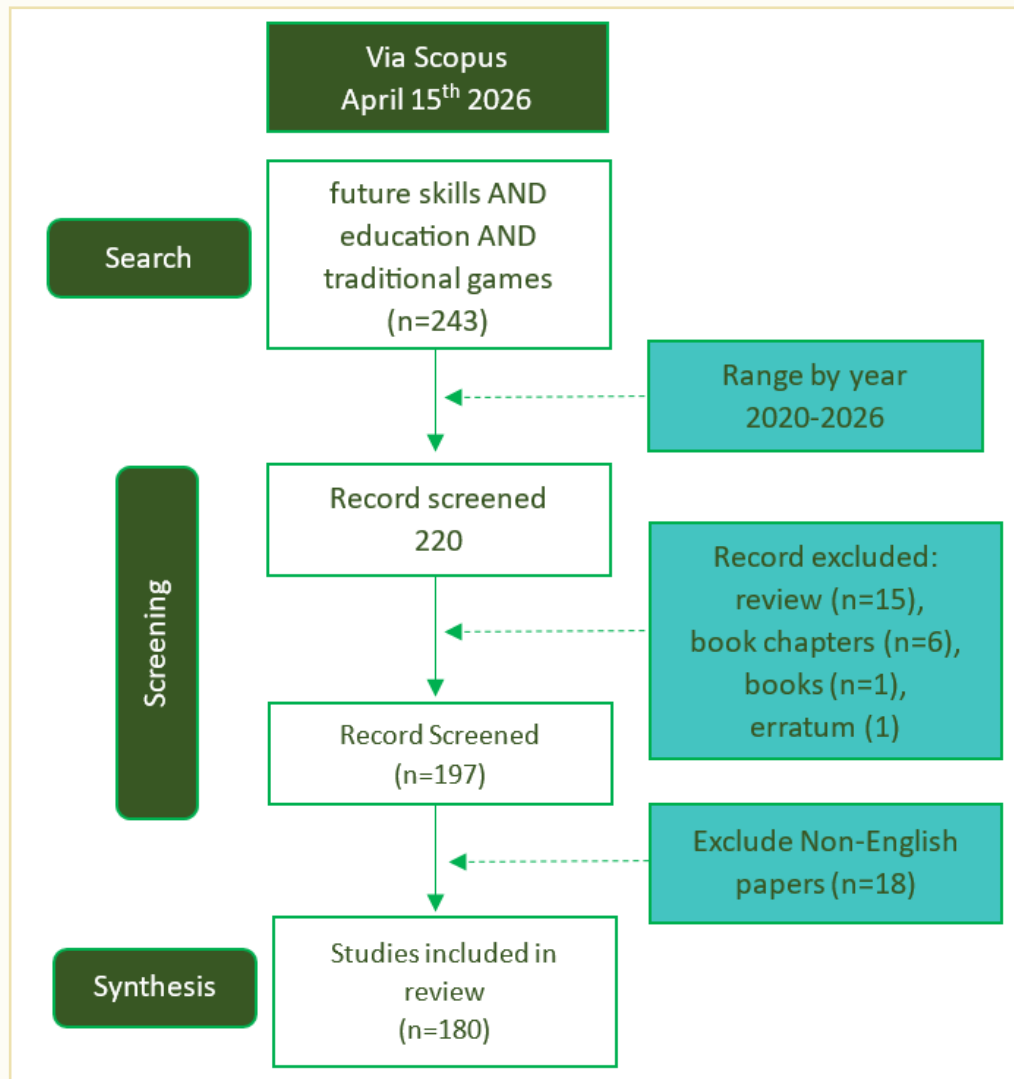


Figure 1 Selection Result of Using PRISMA Protocol

RESULTS

1. The Publication Trends, Top Countries, and Affiliations

Based on the Scopus data analysis, the number of publications on future skills through traditional games demonstrates a relatively emerging and fluctuating trend. As shown in the documents-per-year chart, the field exhibits low publication frequency in the early years (2011-2015), indicating that the topic had not yet gained significant academic attention and remained largely underexplored. A gradual increase in publications is observed from 2016 to 2022, reflecting the early development of the field. During this phase, the topic began to gain recognition, particularly in relation to education and skill development. A significant and exponential rise in publications occurs (104) in recent years

(2023-2025), marking a surge of scholarly interest. This trend reflects the increasing recognition of traditional games as a relevant approach within future-oriented education. Overall, the findings indicate a transition from a marginal research topic to an emerging and rapidly expanding field, particularly in the context of culturally grounded approaches to future skills development.

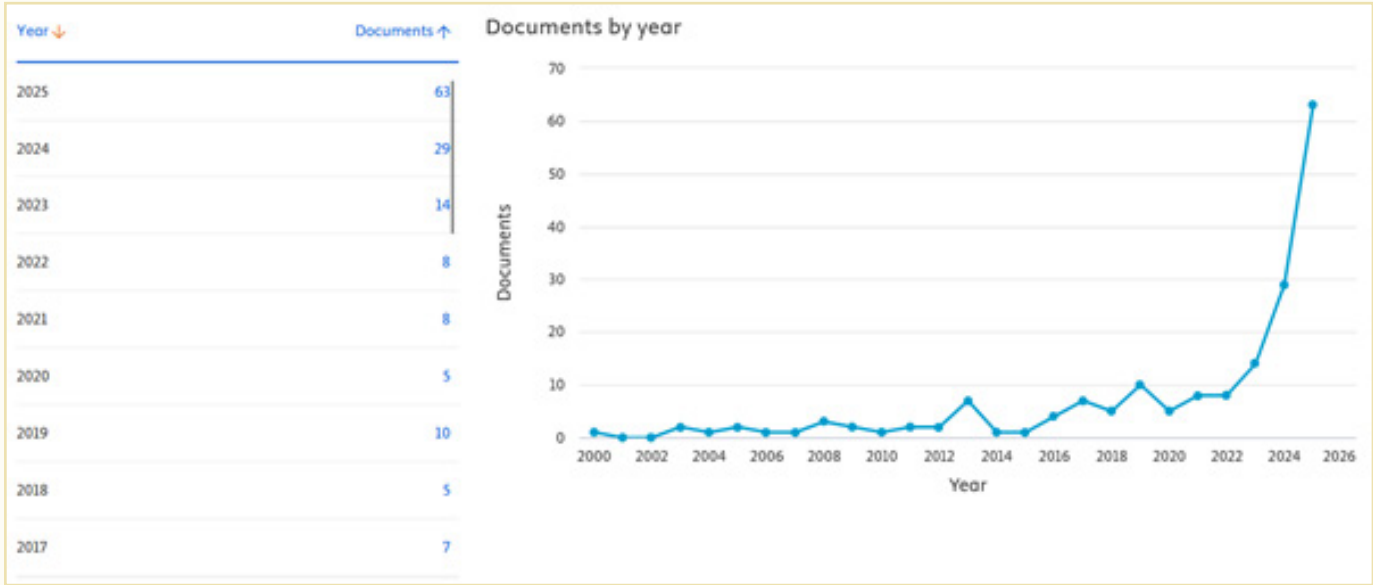


Figure 2 Chart of Topic Trends of Future Skills through Traditional Games

An analysis of the data by country reveals that the United States has conducted the most research on this topic, with 34 studies, followed by China and Italy, with 11 scientific publications each. In terms of citation impact, the United States also leads significantly (493 citations), followed by China (175 citations) and the United Kingdom (151 citations), indicating strong academic influence. The United Kingdom (151) and Spain (121) also achieved a relatively high number of citations, indicating that the studies conducted are highly relevant and are therefore cited frequently in other research. In terms of collaboration strength, the United States shows the highest total link strength (340), indicating its central role in global research networks. Interestingly, Malaysia demonstrates a relatively high collaboration strength (275) despite having fewer publications, suggesting strong international networking.

The country collaboration network reveals that the United States emerges as the most dominant and central contributor (340), reflecting its central role in global research collaboration. Notably, Malaysia demonstrates a relatively high collaboration strength (275) despite having fewer publications, suggesting active participation in international research networks. In contrast, countries such as Indonesia show lower total link strength (66), indicating more peripheral involvement. Interestingly, Taiwan records a high citation (281), but relatively low collaboration strength (58), suggesting strong research impact but limited integration into global collaboration networks.

Table 1 Countries with the highest number of documents and citations:

Country	Frequency	Total Citations	Total Link Strength
United States	34	493	340
Malaysia	8	34	275
Spain	9	121	213
Mexico	5	77	177
Netherlands	6	10	176
Italy	11	84	171

United Kingdom	10	151	145
Canada	6	82	131
China	11	175	94
Australia	8	51	69
Indonesia	7	21	66
Taiwan	6	281	58
Greece	7	63	31
India	8	22	10

Notes: Countries with documents more than 5 are included

Indonesia is present in the network but with relatively limited connections and influence, highlighting its position as an emerging contributor rather than a leading actor in the field. This imbalance suggests that the global discourse on future skills is predominantly shaped by technologically advanced countries, potentially overlooking culturally grounded approaches from developing regions. Countries like Indonesia, with rich traditions of indigenous games, offer valuable yet underrepresented perspectives that could contribute to a more holistic understanding of future skills.

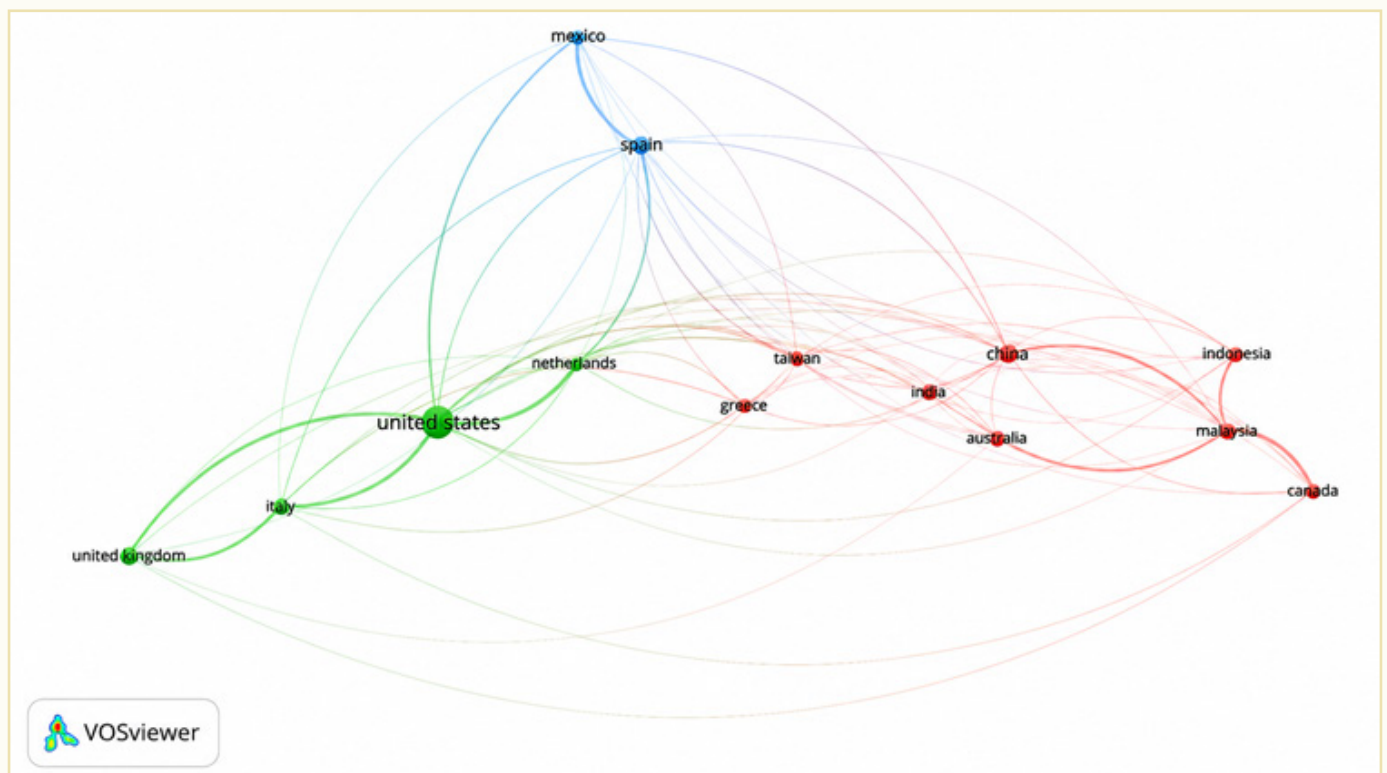


Figure 3 Representation of VOSviewer for Countries Collaboration Network

The above figure shows a VOSviewer-based international collaboration network among countries contributing to research on future skills through traditional games. The visualization indicates that the United States occupies the most central position, reflecting its dominant role in global research collaboration and publication productivity. The United States occupies the most central position, indicating its dominant role in publication productivity and global research collaboration. Strong collaborative relationships are also observed among Malaysia, Spain, Italy, and the United Kingdom, while Indonesia appears more peripheral with relatively limited collaboration strength. This pattern reflects an imbalance in global knowledge production, where technologically advanced countries continue to dominate the discourse, whereas culturally grounded perspectives from developing regions remain underrepresented.

Table 2 shows the highest data by institution in this topic. Interestingly, all listed institutions contribute equally in terms of publication output, with each producing two documents. This indicates the absence of a dominant institutional contributor. The highest number of citations comes from The Ohio State University (69), followed by Ontario Tech University (35) and Stevens Institute of Technology (20), suggesting varying levels of academic influence despite similar productivity. The article was published in 2011 and has been cited in numerous other research studies. The organizational analysis reveals a highly distributed pattern of knowledge production, where no single institution emerges as a dominant contributor. Most organizations are associated with only a single or a couple of publications, yet demonstrate relatively fine total link strength, indicating active participation in collaborative networks.

The diagram shows the absence of a leading institution, suggesting a fragmented research structure, where knowledge production is distributed rather than centralized. From a collaboration perspective, The Ohio State University and Moscow City University exhibit the highest total link strength (7), indicating stronger integration within the research network. In this context, emerging contributors, including institutions from Indonesia, have a strategic opportunity to play a more influential role by introducing contextually grounded and culturally relevant approaches. However, the overall network structure, as visualized in VOSviewer, remains dispersed and weakly connected, reflecting limited institutional collaboration.

This distributed pattern also implies the lack of a unified or dominant theoretical framework, leaving room for new perspectives to emerge. It is within this space that alternative approaches, particularly those rooted in cultural and indigenous practices, can offer meaningful contributions.

Table 2 Institutions with the highest number of documents and citations

Affiliation	Country	Documents	Citation	Total Link Strength
Pennsylvania State University	United States	2	7	2
Ontario Tech University	Canada	2	35	3
The Ohio State University	United States	2	69	7
Turun Yliopisto	Finlandia	2	12	5
Stevens Institute of Technology	United States	2	20	3
Universidad de Granada	Spain	2	13	3
National and Kapodistrian University of Athens	Yunani	2	4	3
Vyatka State University	Rusia	2	4	3
Moscow City University	Rusia	2	5	7
Consiglio Nazionale delle Ricerche	Italy	2	4	3
<i>Notes:</i> Only institutions with more than 1 document and more than 3 citations are included				

The VOSviewer-based institutional collaboration network is showed on figure 4 that reveals a relatively fragmented yet interconnected pattern of research collaboration in the field of future skills through traditional games. Most institutions are concentrated within the central area of the network, forming several collaborative clusters that indicate active knowledge exchange and joint research activities. Institutions such as Arizona State University, Stevens Institute of Technology, Aristotle University of Thessaloniki, State University of Jakarta, and several others occupy more central positions, reflecting stronger collaborative engagement and greater integration within the research network. In contrast, institutions such as Child Study and Human Development, Birzeit University, California State University, Research Institute of China, and Advanced Computing Center appear on the periphery, suggesting more limited collaborative involvement. The presence of several isolated or weakly connected nodes further indicates that institutional collaboration remains uneven and dispersed across the field. Overall, the network structure suggests that research on future skills through traditional games is still an emerging area characterized by distributed knowledge production, moderate levels of institutional connectivity, and the absence of a dominant research hub. This pattern highlights significant opportunities for strengthening international collaboration and developing more integrated research agendas to advance the field.

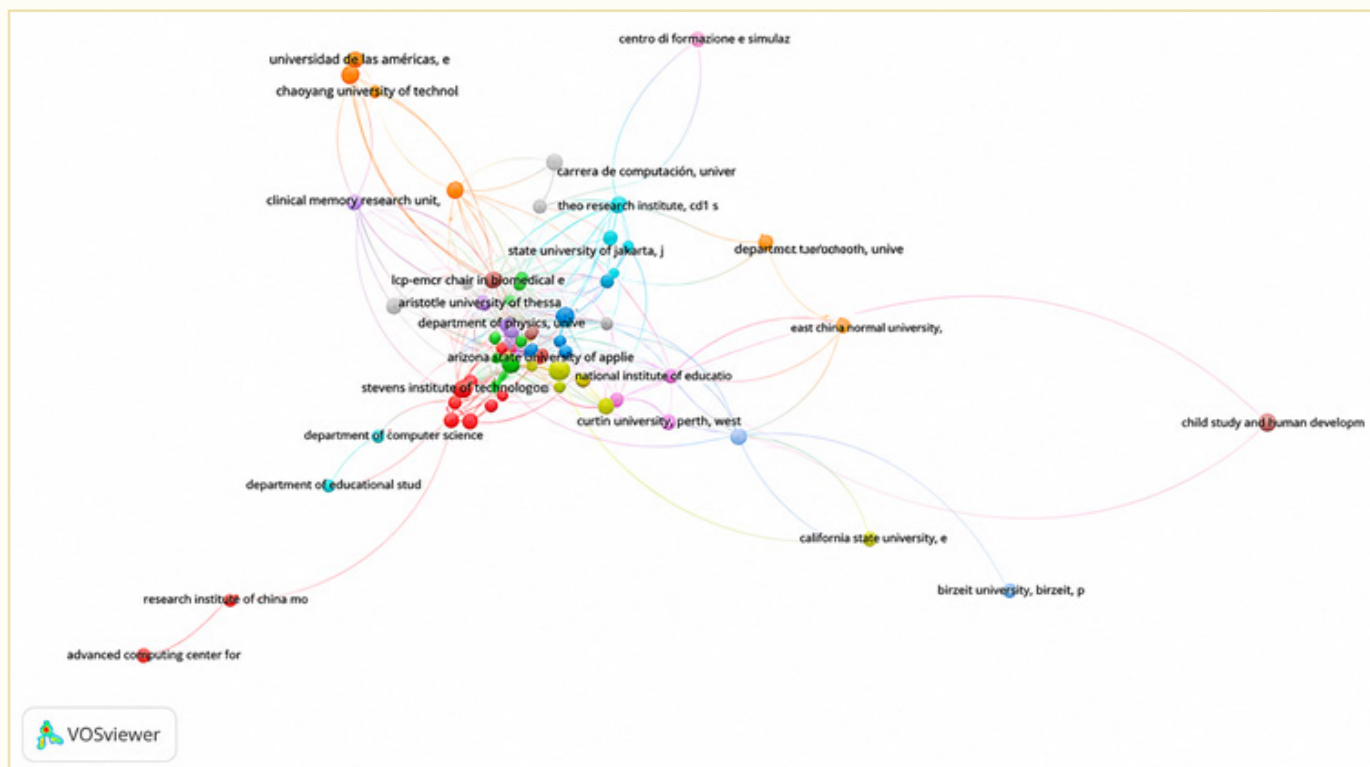


Figure 4 Representation of Vosviewer for Institutions Collaboration Network

Therefore, institutions from emerging regions, including Indonesia, are not merely peripheral actors but hold strategic potential to redefine the discourse. By integrating traditional games as a culturally embedded form of learning, this study positions itself within this open and evolving landscape, contributing to a more inclusive and context-sensitive understanding of future skills.

2. Scholars' Profiles And the Titles

2.1 Top Scholars

The scholar's profiles provide important information about the development of future skills through traditional games, including critical thinking, communication, collaboration, and creativity. Table 3 highlights the authors in this literature who have published more than one paper and received more than 10 citations. Altuger, G., as the leading author, has been conducting research in this field since 2008 and has received the most citations (27). Interestingly, most authors tend to share certain similarities, namely a relatively small number of publications (2) and a similar citation trend (20).

Table 3 List of Top Scholars and their impact on Future Skills through Traditional Games

Authors	Citations	Documents	Total Link Strength
Altuger, G.	20	2	128
Arango, F.	20	2	128
Aziz, E.S.	20	2	128
Chassapis, C.	20	2	128
Esche, S.	20	2	128
Nikolic, D.	27	2	0
<i>Notes: Only authors with more than 10 Citations or more than 1 document are included</i>			

The authors' contribution to the literature on future skills through traditional games demonstrates recognition of their expertise and reveals a relatively concentrated yet collaborative pattern within the research field. The authors, Altuger, G., Arango, F., Aziz, E.S., Chassapis, C., Esche, S., Nikolic, D., demonstrate identical bibliometric profiles, each contributing two publications with 20 citations and notably high total link strength (128). This uniformity suggests the presence of a closely connected collaborative cluster, likely representing co-authored works within a shared research network.

The high total link strength observed among these authors indicates strong relational ties and active participation in collaborative knowledge production. Rather than functioning as isolated contributors, these authors appear to be embedded within a cohesive scholarly network that facilitates the exchange and dissemination of ideas. This pattern reflects a collective authorship structure, where the impact is generated not only through individual productivity but also through collaborative synergy.

In contrast, Nikolic, D. presents a different profile, with a slightly higher citation count (27) but a total link strength of zero. This indicates that, despite having a comparable number of publications, the author operates independently without significant collaboration within the mapped network. Such a pattern suggests an individualized contribution that may carry academic influence but lacks integration into the broader research community. These findings indicate a strongly interconnected collaborative cluster alongside isolated contributors, indicating an evolving scholarly ecosystem where collaboration is present but not uniformly distributed.

2.2 Top Sources

The top sources publishing literature on future skills through traditional games are listed in Table 4. The number of published documents (N) from each source varies, with some having the highest frequency. The ASEE Annual Conference and Exposition Conference Proceedings contain the highest number of documents (11), followed by the Proceedings of the European Conference on Games-Based Learning (6), and the Journal of Educational Computing Research (4).

Table 4 Top Sources

Sources Name	N	Citations	Total Link Strength	Cite Score
ASEE Annual Conference and Exposition Conference Proceedings	11	48	4	0.8
Proceedings of the European Conference on Games-Based Learning	6	14	7	1.2
Journal of Educational Computing Research	4	62	3	14.5

Notes: Only sources with more than 3 documents are included

The variation in publication frequency across the sources listed above reflects their commitment to disseminating research on future skills through traditional games. The analysis from the above data publication sources reveals a differentiated pattern between productivity, citation impact, and network connectivity. Among the identified sources, the ASEE Annual Conference and Exposition Conference Proceedings emerges as the most productive outlet, contributing 11 documents. However, its citation impact (48 citations) and CiteScore (0.8) remain relatively moderate, suggesting that while it serves as a primary dissemination platform, its academic influence is comparatively limited.

Similarly, the Proceedings of the European Conference on Games-Based Learning contributes 6 documents with a lower citation count (14 citations), but demonstrates the highest total link strength (7). This indicates a stronger role in fostering collaboration and connectivity within the research network, positioning it as a key venue for knowledge exchange despite its modest citation impact. In contrast, the Journal of Educational Computing Research exhibits a different profile, with fewer publications (4) but the highest citation count (62) and a significantly higher CiteScore (14.5). This suggests that although the journal contributes less frequently to the field, it has a substantially greater academic impact and visibility.

Overall, these findings indicate a structural imbalance in source contributions, where highly productive sources are not necessarily the most influential, and highly influential journals are not the most productive. This pattern reflects a fragmented publication landscape, where knowledge dissemination is spread across conference proceedings and journals with varying levels of impact and connectivity. It also suggests that the field has not yet consolidated around a core set of high-impact journals, reinforcing its status as an emerging and evolving research domain.

3. The Most Influential Literature

In this part, we will answer RQ 3: What are the main themes and findings discussed in the most influential publications on future skills through traditional games?

The most influential literature can be identified using VosViewer and combined with results from Scopus, sorted by citations, with the findings as shown in Table 5:

Table 5 The Most Highly Cited Sources

Rank	Citation	Author(s)	Sources
1	234	[29]	Computers and Education
2	117	[30]	American Journal of Sports Medicine
3	101	[31]	Asia Pacific Education Researcher
4	99	[32]	Conference on Human Factors in Computing Systems Proceedings
5	88	[33]	Physical Education and Sport Pedagogy
6	70	[34]	Computer Applications in Engineering Education
7	63	[35]	Simulation in Healthcare
8	59	[36]	Frontiers in Psychology
9	40	[37]	International Journal of Aerospace
10	37	[38]	Journal of Computers in Education

Across the studies, the main findings consistently demonstrate that game- and simulation-based approaches significantly improve essential future skills, including collaboration, critical thinking, engagement, and problem-solving. These outcomes are observed across various contexts, including higher education, healthcare training, and physical education.

4. Keyword Trends and Thematic Analysis

The keyword co-occurrence analysis reveals a highly structured yet technology-dominated research landscape. Three major thematic clusters emerge from the network visualization. The first cluster, centered around educational technology, includes keywords such as e-learning, computer games, and learning systems, indicating a strong emphasis on digital learning environments. The second one reflects applied learning and skill development, particularly within simulation-based and professional training contexts, as evidenced by terms such as simulation, medical education, and skill. And the third cluster highlights pedagogical and behavioral aspects, including teaching, motivation, and physical education, suggesting a focus on learning processes and learner engagement. Notably, the dominance of technology-related keywords indicates a strong techno-centric orientation within the field. In contrast, traditional games are largely absent from the network, highlighting their marginal position in the current research discourse despite their demonstrated educational potential.



Figure 4 Co-occurrence network analysis

Table 6 Keyword Trends

Ranking	Keyword	Occurrences	Total Link Strength
1	Students	66	381
2	Teaching	37	286
3	Education	34	236
4	Virtual reality	27	215
5	Engineering education	34	214
6	Human	22	209
7	Curricula	28	206
8	Gamification	34	205
9	Humans	18	173
10	Education computing	25	172

Table 7 Thematic analysis of keyword co-occurrences

Main Theme (Color)	Sub-theme	Description (EN)	Nodes Example
Educational Technology and Digital Pedagogy (Red)	Educational Technology	This theme reflects the dominance of technology-driven learning environments, where digital tools such as e-learning systems, computer games, and learning platforms shape the educational experience. It highlights a paradigm where learning effectiveness is closely associated with technological integration.	e-learning, computer games, educational games, learning systems
	Learning Theory	This sub-theme highlights theoretical perspectives such as constructivism and cognitive learning, emphasizing how learners actively construct knowledge through interactive and digital environments. It reflects an interest in understanding cognitive processes in technology-mediated learning.	constructivism, cognition, critical thinking, active learning
	Game-based Learning	This sub-theme emphasizes the use of digital and serious games as instructional tools to enhance engagement, motivation, and problem-solving skills. It reflects the growing adoption of game mechanics in formal education.	game-based learning, serious games, gamification, engagement

Immersive Learning Environments and Research Method (Green)	Immersive Technologies	This theme focuses on immersive technologies such as virtual reality (VR), augmented reality (AR), and mixed reality (MR), which enable experiential and embodied learning. It reflects the increasing interest in creating realistic and interactive learning environments.	virtual reality, augmented reality, mixed reality, simulation
	Student-centered Learning	This sub-theme highlights the importance of learner experience, engagement, and self-efficacy. It emphasizes personalized and participatory learning approaches within digital environments.	student, university, self-efficacy, problem-based learning
	Research Method	This sub-theme indicates the dominance of quantitative approaches in studying technology-enhanced learning, often using surveys and experimental methods to measure learning outcomes.	quantitative analysis, questionnaire, experiment
Pedagogical Interaction and Learning Outcomes (Blue)	Interactive Learning	This theme highlights the role of interaction between learners, teachers, and systems in shaping learning outcomes. It emphasizes dynamic and engaging learning environments.	interactive learning, engagement, learning outcomes
	Motivation and Behavior	This sub-theme focuses on motivational factors and behavioral engagement as key drivers of learning success in digital environments.	motivation, behavior, participation
	Skill Development	This sub-theme reflects the development of future skills such as problem-solving, collaboration, and critical thinking through learning processes.	skill, problem solving, collaboration, creativity

DISCUSSION

The findings of this study provide compelling evidence that the global discourse on future skills remains structurally imbalanced and epistemologically skewed toward techno-centric paradigms. This is clearly reflected in the keyword co-occurrence network, where dominant terms such as virtual reality, gamification, and educational computing occupy central positions, indicating that technological mediation is widely perceived as the primary pathway for developing future competencies. Such dominance aligns with prior studies that emphasize digital innovation as the main driver of 21st-century skills development [16]. However, this study extends beyond confirmation by revealing a critical absence: the marginalisation of culturally embedded learning practices, particularly traditional games.

From a bibliometric perspective, the absence of “traditional games” as a prominent node within the keyword network is not merely a quantitative gap, but a conceptual one. It indicates a disconnection between empirical evidence and research discourse. While numerous studies (as shown in the systematic review component) consistently demonstrate that traditional games foster collaboration, creativity, critical thinking, and social interaction [9], These practices remain peripheral in the global knowledge structure. This misalignment suggests that the field is influenced by a form of technological determinism, where innovation is equated with digitalization, thereby overshadowing alternative, culturally grounded learning modalities [39].

Furthermore, the country and collaboration-network analyses reinforce this imbalance. The dominance of Global North countries, particularly the United States, the United Kingdom, and Italy, highlights their central role in shaping research agendas and knowledge production. Their high total link strength indicates strong integration within global research networks, allowing them to define dominant paradigms. In contrast, countries such as Indonesia, despite possessing rich traditions of indigenous games, remain positioned at the periphery with limited collaboration strength. This disparity suggests that the underrepresentation of traditional games is not accidental but structurally embedded within the global academic ecosystem.

Interestingly, the institutional and source analyses reveal a fragmented and decentralized knowledge structure. The absence of a dominant institution or core journal suggests that the field has not yet reached theoretical or conceptual maturity. While this fragmentation may indicate a lack of consolidation, it simultaneously presents a strategic opportunity. In such an open and evolving field, alternative perspectives, particularly those rooted in sociocultural and experiential learning theories, have the potential to redefine the discourse.

The thematic clusters further strengthen this interpretation. Although the field encompasses diverse themes, including immersive technologies, student-centered learning, and skill development, these themes are predominantly mediated through digital environments. This reinforces the notion that future skills are conceptualized within technologically bounded frameworks. However, from a sociocultural perspective [19], Learning is inherently situated, interactive, and culturally mediated. Traditional games, in this context, offer a powerful yet underutilized platform for embodied, collaborative, and meaningful learning experiences.

Thus, this study argues that the marginalization of traditional games reflects not a lack of relevance but a systemic bias in knowledge production. The current discourse privileges technologically scalable solutions, often at the expense of culturally sustainable and socially grounded practices. By integrating findings from bibliometric mapping and systematic review, this study challenges the prevailing narrative and calls for a broader epistemological shift.

In this regard, traditional games should be repositioned not as supplementary or nostalgic practices, but as legitimate pedagogical frameworks capable of fostering future skills in holistic and contextually meaningful ways. Their inherent characteristics, interaction, collaboration, rule negotiation, and cultural transmission align closely with the core dimensions of future skills, offering an alternative pathway that complements, rather than competes with, technological approaches.

PEDAGOGICAL RECOMMENDATIONS

The findings of this study indicate the need for a more inclusive approach to future skills education. While technology-driven pedagogies continue to dominate the contemporary educational context, the results demonstrated that culturally grounded learning approaches, particularly traditional games, possess substantial pedagogical recommendations that can be proposed to support more human-centered, socially interactive, and culturally responsive educational practices [40]. Here are a few recommendations:

First, traditional games should be integrated into formal and non-formal educational settings as experiential and collaborative learning approaches. Educational institutions can incorporate traditional games into classroom instruction, project-based learning, outdoor learning activities, and community-based educational programs to foster communication, collaboration, creativity, critical thinking, and problem-solving skills [41]. Unlike purely technology-mediated instruction, traditional games create embodied learning experiences that encourage active participation, and peer interaction that encourage active participation, peer interaction, and collective meaning-making [42]. Such approaches are particularly relevant in supporting holistic learner development within culturally diverse educational contexts.

Second, educators need to reposition their pedagogical roles not only as transmitters of knowledge but also as facilitators of socially meaningful and culturally contextualized learning experiences. In this regard, teachers should be encouraged to design learning environments that integrate local wisdom, cultural interaction, and experiential engagement into future skills education [43]. Traditional games can function as pedagogical tools that connect academic learning with learners' social realities, thereby increasing learner engagement, motivation, and emotional connection to the learning process. This approach aligns with sociocultural and constructivist perspectives that emphasize learning as a collaborative and contextually situated process.

Third, curriculum developers and educational policymakers should consider integrating culturally responsive pedagogy into future-oriented educational frameworks. Current educational policies frequently emphasize technological literacy and digital competencies; however, future skills education should also recognize the importance of social interaction, cultural identity, ethical values, and community participation. Integrating traditional games into educational curricula can help preserve cultural heritage while supporting the development of future competencies [44]. Such integration is especially important in countries with rich indigenous traditions and diverse cultural learning practices.

Fourth, future educational innovation should move toward a balanced pedagogical paradigm that combines technological advancement with human-centered and culturally meaningful learning approaches. Technology should not be viewed as the only pathway for educational innovation.

Instead, future skills education should promote pedagogical diversity by valuing experiential, socially interactive, and culturally grounded forms of learning alongside digital innovation. In this context, traditional games can serve as complementary pedagogical approaches capable of fostering sustainable, inclusive, and contextually relevant learning experiences [45].

CONCLUSION AND IMPLICATIONS

This study reveals that the current landscape of future skills research is largely technocentric and geographically concentrated, dominated by Global North countries and digital learning paradigms. While these approaches have advanced educational innovation, they have also marginalized culturally grounded practices such as traditional games. This creates a clear misalignment between empirical evidence, highlighting the effectiveness of traditional games in fostering essential competencies, and a research discourse that continues to prioritize technology-driven solutions. By integrating bibliometric mapping and systematic review, this study goes beyond descriptive analysis to uncover structural and conceptual gaps, including fragmented knowledge production and the absence of a unified epistemic core. It thus repositions traditional games as a legitimate and powerful framework for developing future skills, grounded in sociocultural interaction, experiential learning, and indigenous knowledge.

The implications are threefold. Theoretically, the study calls for a shift toward a more inclusive, human-centered, and culturally responsive understanding of future skills. Practically, it encourages the integration of traditional games into formal and non-formal education to support holistic skill development. From a research perspective, it highlights the need for more context-sensitive, diverse, and methodologically robust studies, particularly from underrepresented regions. In conclusion, future skills development should not be confined to technological advancement alone, but must also embrace culturally embedded and socially meaningful learning practices. Traditional games, therefore, offer a valuable pathway for fostering sustainable and future-ready competencies.

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