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EXPLORING THE TREND OF EXPERIENTIAL LEARNING IN HIGH SCHOOL: A BIBLIOMETRIC ANALYSIS IN SCOPUS DATABASE

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Abstract. Experiential learning has become increasingly popular in many countries around the world. This learning method is widely applied across various educational levels and fields. In this study, we evaluate the scientific outcomes of research publications on experiential education in high schools, using scientific data extracted from the Scopus database. A bibliometric analysis was conducted with 231 documents that were filtered according to our research criteria. The results show that the USA has the highest number of publications on this topic. Research trends are quite diverse, with recent studies mainly focusing on experiential learning in STEM education, experiential learning with virtual reality technology, and others. The research collaboration network among countries shows that the USA collaborates with most countries in this field. Growth trends are not yet high and continuous, and other results are detailed in the research findings section.

Keywords: experiential learning, bibliometrics, Scopus, high school.

1. Introduction

The development of science and technology has changed people's perceptions of education. Many educational viewpoints and theories have been applied in schools and have become guiding principles in the mission of education [1], [2]. In these approaches, educational trends focus on the holistic development of learners, creating opportunities for students to explore, enhance their experiences, and guide the application of knowledge to solve real-life problems.

Experiential Learning Theory (ELT) provides a comprehensive view of the learning process, presenting a nonlinear model of human cognitive development and offering insights into how people learn, mature, and grow [3]. This theory is considered a positive educational philosophy in which educators intentionally engage learners in direct experiences, through which learners acquire knowledge, skills, and values. The intellectual origin of experiential learning is an excellent combination of the classical works of Dewey, Lewin, and Piaget, forming a unique perspective on learning and development [4]. Two key concepts that define this theory are "experience" and "reflection" [5]. Experiential learning occurs in diverse contexts, with various

organizational forms suited to the educational space, target learners, and activity objectives, and is applied at all educational levels, from preschool, primary, and secondary school (K-12 education) to higher education [6]-[8]. Research on experiential learning has been conducted in various fields such as entrepreneurship education [9], sustainable agricultural education [10], geography education [11], medical education [12], mathematics education, and science education, among others.

Bibliometric analysis has developed rapidly in recent years [13]. This method enables researchers to quantitatively analyze academic literature based on reliable databases [14]. Globally, bibliometric and systematic reviews on experiential education across diverse fields have been conducted [15], [16]. However, no bibliometric analysis has focused specifically on experiential education in high schools. This gap is critical because experiential learning, while widely applied and evaluated in higher education, remains underexplored at the secondary level, where curricular reforms increasingly emphasize practice-oriented, student-centered learning. A systematic mapping of trends, influential authors, and thematic clusters is therefore needed to provide evidence-based insights for researchers, educators, and policymakers. By addressing this gap, the present study contributes a comprehensive bibliometric analysis of experiential learning in high school contexts, offering both an overview of the knowledge base and directions for future research.

In this study, we conduct a bibliometric analysis of scientific publications on experiential education in high schools to answer four research questions (RQ): RQ_1- What are the general characteristics and growth trends of scientific publications related to experiential education in high schools? RQ_2 - How is the international research collaboration network among countries in this field represented? RQ_3 - Which countries, organizations, and scholars are at the top of the rankings in terms of the number of publications on experiential education in high schools? RQ_4 - What are the key and popular research topics in this field of study?

2. Content

2.1. Methodology

In social science research, five major databases are commonly used for bibliometric analysis: Web of Science (WoS), Scopus, Google Scholar, Microsoft Academic, and Dimensions [17]. WoS and Scopus are the two most trusted and frequently used databases for bibliometric analysis. In line with the purpose and conditions of this study, we decided to use the Scopus database as the platform for retrieving publications.

To ensure the accuracy and generalizability of the research results, we applied a general scientific mapping process, carried out in five interconnected stages: 1) Research design; 2) Data collection; 3) Data analysis; 4) Data visualization; and 5) Interpretation [18].

In the Research Design phase, we focused on clarifying the main research question: What is the bibliography of research publications indexed in the Scopus database related to experiential learning in high schools? The Data Collection phase was divided into three steps: data collection, data filtering, and data cleaning.

**** Step 1**: Data collection.* We queried Scopus (Advanced Search) on April 8, 2025, using the field code TITLE-ABS-KEY. The search string deliberately incorporated multiple experiential-learning variants (e.g., “experiential learning,” “hands-on learning,” “learning by doing,” “work-based learning”), which are widely acknowledged in the literature as conceptually convergent with Kolb’s experiential learning theory. Proximity operators (e.g., Experiential W/2 Learning) were applied to capture meaningful semantic pairings and avoid spurious hits, thereby

enhancing both recall and precision. To ensure contextual relevance, these terms were further restricted to co-occur with descriptors of "secondary education" and "high school." The exact query is provided in Figure 1.

TITLE-ABS-KEY(((experienti* W/2 (learn* OR educat*)) OR "learning by doing" OR ("hands-on' W/1 learn*) OR "activity-based learning" OR "authentic learning" OR "service-learning" OR "service learning" OR "place-based learning" OR "place based learning" OR "community-based learning" OR "community based learning" OR "practice based learning" OR "outdoor learning") AND ("high school*" OR "senior high" OR "upper secondary" OR "K-12" OR "K12" OR "grade 10" OR "grade 11" OR "grade 12")) AND (LIMIT-TO(DOCTYPE, "ar") OR LIMIT TO(DOCTYPE, "re")) AND (LIMIT-TO(LANGUAGE, "English"))

Figure 1. Description of the query string used for data search in Scopus

**** Step 2**: Data Filtering.* The search results based on the keyword set were filtered using several automatic functions integrated on the Scopus website, with the conditions established in Step 1. We then exported the data in both Bib and CSV formats for post-processing analysis using popular bibliometric analysis tools VOSviewer [19] and Biblioshiny [17]. Additionally, we also used the Scimago website https://www.scimagojr.com/ and Microsoft Excel software for information retrieval and research result analysis.

**** Step 3**: Data Cleaning.* A total of 302 documents were initially extracted. The dataset was refined through a systematic screening of titles and abstracts, applying strict criteria related to the relevance, purpose, and scope of the research topic. To ensure accuracy, all team members independently reviewed and discussed the documents before reaching consensus on inclusion or exclusion. The final dataset retained for bibliometric analysis comprised 231 documents on experiential education in high schools.

2.2. Result

In this section, we present the research results by providing scientific information to answer the four research questions we have identified.

2.2.1. What is the general information and growth trends of scientific publications on experiential education in high schools?

As summarized in Table 1, the earliest scientific publication on experiential learning in high schools appeared in 1982, describing one of the longest-running programs for students in Pulaski, Wisconsin, and was published in the Taylor & Francis journal system. From 1982 to April 2024, a total of 231 publications were identified, comprising 146 journal articles (63.2%) and 85 conference papers (36.8%), drawn from 155 different Scopus-indexed sources.

Authorship analysis shows 718 authors across the dataset. Among them, 32 publications (13.85%) were single-authored, while the majority, 199 publications (86.15%), involved multiple authors. The average number of co-authors per publication was 3.26. International collaboration, measured by the proportion of internationally co-authored works, reached 7.792. The annual growth rate of publications was 4.74%, which is relatively modest and uneven across periods, suggesting that although the topic attracts scholarly interest, overall research output remains limited.

The evaluation of the quality of the documents through citation data, as shown in Table 2, indicates that journal articles are of higher quality, with 1214 citations (accounting for 85.9% of the total citations). The average citation rate is 8.82, nearly four times higher than the citation rate of 2.35 for conference papers.

Table 1. Overview of main information in the collection of publications.

Description	Results	Description	Results
Main information about the data		*Authors*	
Timespan	1982:2025	Authors	718
Sources (Journals, Books, etc.)	155	Authors of single-authored docs	32
Documents	231	*Authors collaboration*	
Annual Growth Rate %	4.74	Single-authored docs	32
Document Average Age	7.24	Co-Authors per Doc	3.26
Average citations per document	6.121	International co-authorships %	7.792
References	6896	*Document types*	
Document contents		Article	146
Keywords Plus (ID)	926	Conference paper	85
Author's Keywords (DE)	703		

Table 2. Citation information for types of scientific products.

Document	Total documents	Total citations	Total documents/ Total citations
Article	146	1214	8.82
Conference Paper	85	200	2.35

The total number of studies published annually and the cumulative number of citations over the years from 1982 to April 2025 for publications on experiential education in high schools are shown in Figure 2. In the period from 2018 to 2023, the number of publications increased significantly compared to the previous period, although the total number of publications is still relatively low. The surge in cumulative citations in 2014 indicates that high-quality scientific publications in this field gained considerable attention and were frequently cited by researchers worldwide.

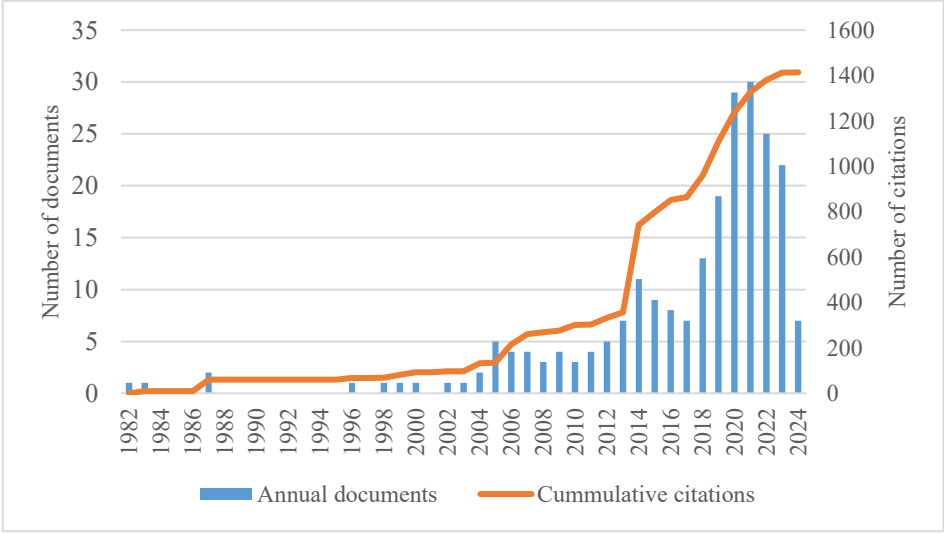

Figure 2. A combined chart illustrating the annual publication count and citation rate

2.2.2. Analyzing the international collaboration network between countries worldwide in this field of research?

In the field of experiential learning research in high schools, international collaboration involves 25 countries organized into six distinct clusters. The United States occupies the central position, maintaining collaborations with six countries. Italy and the United Kingdom follow, each connected to four countries, while Canada, Germany, and Turkey each report three international links. A notable example is the strong bilateral partnership between Malaysia and Indonesia, where co-authorship appears frequently in international publications. Overall, the network shows that while the USA dominates in terms of collaboration breadth, other regional clusters, particularly in Europe and Southeast Asia, also contribute significantly to the field.

2.2.3. Which countries, organizations, or scholars are at the top in terms of the number of publications on experiential education in high schools?

Table 3 presents the top 10 countries/organizations by number of publications, total citations, and citation rate per document. The USA ranks first with 57 publications (24.7%) and 287 citations (20.3%). Indonesia follows with 12 publications, while Canada and Japan each have 7. Italy, South Africa, and Spain occupy the lower positions with 3 publications each. Overall, contributions remain modest, with most of the 45 countries/organizations in the dataset represented by only one publication. In terms of citation impact, Spain stands out with the highest citation rate per document (28.3), followed by Canada (9.0) and Israel (6.8). The remaining countries in the top 10 show citation rates ranging from 0.8 to 6.8. These results highlight both the dominance of the USA in output and the uneven distribution of scholarly influence across countries.

Table 3. List of the top 10 countries/organizations with the most publications

No.	Country/Territory	Total documents	Total citations	Total citations/Total documents
1	USA	57	287	5.00
2	Indonesia	12	9	0.80
3	Canada	7	63	9.00
4	Japan	7	23	3.30
5	China	5	31	6.20
6	Israel	5	34	6.80
7	Greece	4	12	3.00
8	Italy	3	13	4.30
9	South Africa	3	14	4.70
10	Spain	3	85	28.30

Table 4 reports the top five publishing venues on experiential learning in high schools, each with at least seven Scopus-indexed publications. The set comprises three conference venues and two journals. The ASEE Annual Conference and Exposition, Conference Proceedings leads the ranking with 18 publications and 30 citations; its most recent CiteScore is 0.408 (2020), with no CiteScore reported since 2021. The other conferences are Journal of Physics: Conference Series (9 publications; 13 citations; CiteScore 2024 = 0.562) and the Proceedings of the Frontiers in Education Conference (FIE) (8 publications; 20 citations; CiteScore 2024 = 0.908). The two journals are Journal of Experiential Education - the most cited venue in the set (8 publications; 60 citations; Q2; CiteScore 2024 = 2.438) - and American Biology Teacher (7 publications; 21

citations; Q3; CiteScore 2024 = 0.377). Overall, conference CiteScores are modest (0.408-0.908), whereas the journals span Q3–Q2. Collectively, these five venues account for 50 publications and 144 citations (quartiles and CiteScores per SCImago, accessed 6 May 2025).

Table 4. The top 5 organizations are leading.

No.	Published source	Total publications	Total citations	Scopus Quartile* (2024)	CiteScore 2024*	Type
1	ASEE Annual Conference and Exposition, conference proceedings	18	30	_	0.408(2020)	Conference
2	Journal of Physics: Conference Series	9	13	_	0.562	Conference
3	Journal of Experiential Education	8	60	Q_2	2.438	Journal
4	Proceedings - Frontiers in Education Conference, FIE	8	20	_	0,.08	Conference
5	American Biology Teacher	7	21	Q_3	0.377	Journal

** As per data from Scimago Journal & Country Rank on May 6, 2025.*

2.2.4. What are the important and popular research topics in this field of study?

To identify major research topics and trends, we analyzed 703 author keywords from 231 documents. Using VOSviewer, a co-occurrence network of 71 keywords (appearing at least twice) was generated, divided into 11 clusters (Figure 3). Four clusters highlight emerging directions: (i) the red cluster links experiential learning theory with models such as "learning by doing," "active learning," and "STEM education"; (ii) the blue cluster emphasizes applications in high schools with terms like "high school," "robotics," and "chemistry"; (iii) the purple cluster centers on "STEM" and includes "science," "mathematics," "technology," and "cybersecurity"; and (iv) the pink cluster reflects technology-driven approaches, notably "virtual reality," "augmented reality," and "learning experience."

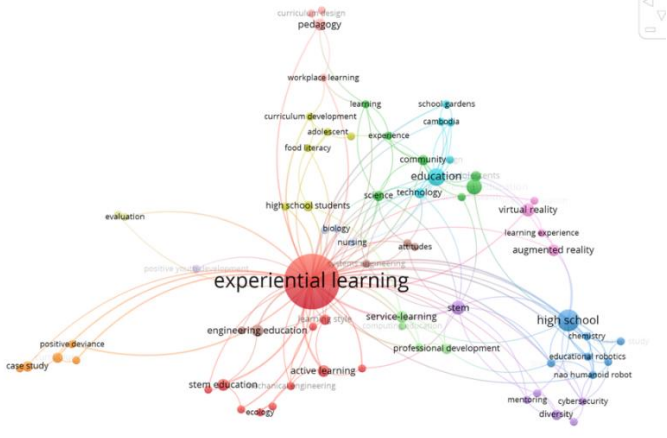

Figure 3. Co-occurrence network of 71 most common keywords (Source: VOSviewer)

To explore research trends through an analysis of research terms, we present Figure 4, which shows the timeline of terms that appear in the publications of the collection we analyzed. Each term displayed in the figure appears in at least five articles within our collection. Most of the terms are similar to the keywords analyzed earlier. However, this figure more clearly illustrates research trends in the field over time. Recent topics that have gained significant attention from researchers include "virtual reality" and "STEM." Although experiential education in high schools has been studied for a long time, recent publications are increasingly linked to STEM education and virtual reality technology. Thus, the two main research trends that scholars are currently focusing on are experiential learning with virtual reality and experiential learning in STEM fields. These are valuable suggestions for researchers in this field.

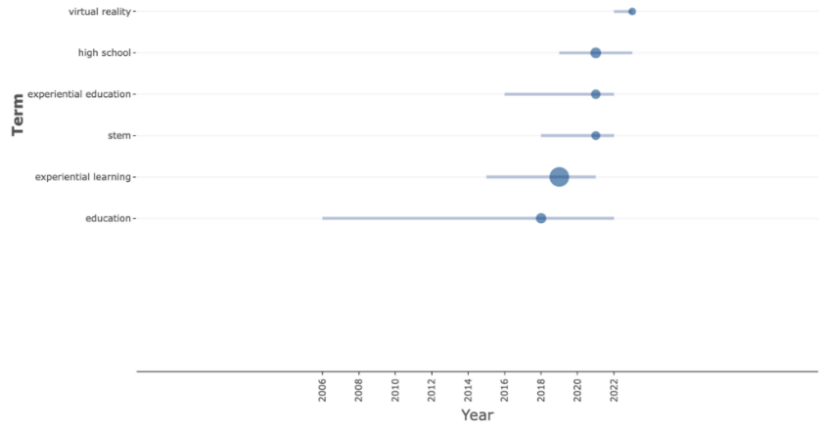

Figure 4. Topic trend of the publication collection (Source: Biblioshiny)

2.3. Discussion

An overview of experiential learning in high schools, analyzed through 231 publications extracted from the Scopus database, addresses four research questions. The average annual growth rate of 4.47% appears modest; however, the timeline spanning from the first study in 1982 to April 2025 shows that the topic has remained present for more than four decades. The limited volume of publications suggests that, despite its pedagogical importance, experiential learning at the secondary level has not yet attracted extensive scholarly attention. One possible explanation is that experiential learning has historically been emphasized in higher education and professional training, while research in high schools has remained relatively scarce [20], [21].

The citation landscape, totaling 1,414 citations with 85.9% from journal articles, indicates that academic legitimacy is concentrated in peer-reviewed journals rather than conferences. The "Journal of Experiential Education" emerges as the most significant contributor, although its quality ranking ranges from Q4 to Q2 (see Table 4). This implies that while dedicated publication outlets exist, the visibility and impact of the field remain limited compared with other established areas.

The temporal trend reveals a notable increase in publications after 2019, closely linked with global reforms emphasizing STEM education and the rapid adoption of educational technology. Studies focusing on the integration of experiential learning with digital and immersive technologies, such as virtual and augmented reality, highlight this shift [22]-[24]. In parallel, STEM-related experiential learning continues to expand as a key area [25], [26], while field-based experiential education remains a strong theme rooted in Deweyan principles [27], [28]. These developments suggest that both technological innovation and curricular reforms serve as external drivers shaping the research agenda.

The global collaboration network remains weak, with the USA leading through collaborations with six other countries. Other countries, such as Indonesia, Canada, and Japan, also appear among the most influential contributors. However, the overall network density is low, revealing limited cross-border knowledge exchange. This fragmentation suggests that experiential learning research often develops in context-specific silos, reducing opportunities for comparative insights and mutual learning across education systems. Strengthening collaboration would enhance methodological diversity and broaden the generalizability of findings.

Keyword analysis further confirms the emergence of VR/AR integration and STEM-focused experiential learning (see Figure 2). This thematic evolution demonstrates a transition from broad advocacy of "learning by doing" toward more specialized and technologically mediated applications. While this enhances relevance to 21st-century skills and classroom innovation, it also risks narrowing the conceptual scope of experiential learning if not balanced with cross-disciplinary inquiry.

Taken together, the findings illustrate both the promise and limitations of the field. Experiential learning in high schools shows strong potential to contribute to educational innovation in the digital era, yet the evidence base remains fragmented, concentrated in a few outlets, and regionally imbalanced. To move forward, future studies should diversify publication venues, expand international collaborations, and maintain equilibrium between technological advances and foundational experiential learning principles. Such strategies would accelerate scholarly progress and strengthen the global impact of research in this domain.

3. Conclusions

This study utilized bibliometric analysis based on documents extracted from the Scopus database, focusing on experiential learning in high schools. The main findings of the study are as follows: 1) Publication Volume and Growth Rate: The total number of publications is still limited, and the annual growth rate is modest. However, the number of publications has increased significantly since 2019. 2) USA's Impact: The USA has the most significant influence in this field, with the largest number of studies and the most highly cited documents authored by researchers from the USA. 3) Collaboration Network: The collaboration network is not robust. Key countries serving as central nodes in the network include the USA, Italy, the United Kingdom, Canada, Germany, and Turkey. 4) Publication Quality: Publications in this field are primarily concentrated in journals ranked between Q4 and Q2.5. Research Trends: Emerging trends focus on integrating experiential education with virtual reality technologies and their application in STEM fields.

Notwithstanding the contributions of this study, certain limitations merit consideration: Firstly, the exclusive focus on publications about experiential learning in high schools within the Scopus database is insufficient to comprehensively evaluate the development and trends in this field. Secondly, the accuracy of standardized information in the Scopus database, such as organization names, scholar names, and abbreviations, can influence our analysis results. For instance, inconsistencies in these details may affect the interpretation of findings. Thirdly, although our manual data filtering process adhered to stringent criteria for inclusion or exclusion, minor oversights could still occur. Fourthly, technical limitations of the software tools used, such as Biblioshiny and VoSviewer, may have impacted the precision of our analysis. Lastly, while tools like CiteSpace [29] and SciMat [30] offer unique advantages for bibliometric analysis, they were not utilized in this study. Incorporating these tools will be a focus of future research.

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