

Trends of cultural studies in science education: A systematic review from 1973 to 2023

Marina R. Zheltukhina ^{1*} , Natalia N. Kislitsyna ² , Olga V. Sergeeva ³ , Svetlana A. Knyazeva ⁴ ,
Ivan P. Polovikov ⁴ , Leysan R. Tukhvatullina ⁵ 

¹ Department of English Philology, Volgograd State Socio-Pedagogical University, Volgograd, RUSSIA

² V. I. Vernadsky Crimean Federal University, Simferopol, RUSSIA

³ Kuban State University, Krasnodar, RUSSIA

⁴ Sechenov First Moscow State Medical University, Moscow, RUSSIA

⁵ Kazan (Volga region) Federal University, Kazan, RUSSIA

Received 02 August 2023 ▪ Accepted 19 October 2023

Abstract

In this study, a systematic literature review on cultural studies in science education between 1973 and 2023 was conducted through the Scopus database. Content analysis was used in this study in which 277 articles from the last 50 years were reviewed. According to the guidelines of Petticrew and Roberts (2006), trends of cultural studies in science education were investigated in terms of annual accounts, number of articles by authors, distribution of articles by country, most productive journals, most cited articles, and most preferred research methods. The results showed that research on cultural studies in science education fluctuated between slowing down and positively accelerating. The growth rate of the articles peaked in 2013. Three authors have three papers, twenty authors have two papers, and the rest of author each have one paper in terms of the distribution of number of authors. Analysis revealed that most articles come from countries such as the United States, the United Kingdom, and Germany, while interest in this area is growing in countries such as Australia, Canada, and Turkey. Cultural Studies of Science Education, International Journal of Science Education, International Journal of Psychology, and Science and Education being the most productive journals in this field. The most cited article with 160 citations was published in 2012 by Nagengast and Marsh (2012) in Journal of Educational Psychology. Finally, the most popular research design was quantitative research method followed by mixed (quantitative and qualitative together) research method. Some implications are proposed for future studies.

Keywords: cultural studies, science education, systematic review, content analysis

INTRODUCTION

Scholars have given different definitions of cultural studies in science education. Kinslow et al. (2019) described it as an investigation of how culture affects teaching and learning in science, while Dimick (2012) defined it as the study of how social and cultural factors impact students' ability to engage with and succeed in science. The fundamental objective of this field is to comprehend the interplay between culture and science education, while also finding ways to increase cultural

responsiveness within scientific pedagogy. Science education is seen as a means of incorporating cultural practices and viewpoints into science classrooms, especially for students who have been marginalized in the past. Allchin (2014) categorized cultural studies in science education as a method that encourages genuine scientific learning opportunities for everyone. Different meanings of the term emphasized the significance of acknowledging cultural aspects in science education, inclusive of students from various cultural backgrounds. It is vital to take these factors into account when

Contribution to the literature

- This article provides historical background and outlines possible future directions.
- This study shows us how culture plays a role in shaping how we teach and learn science.
- It's a valuable resource in making science education more inclusive and relevant to different communities.

developing science curricula and teaching methods in the classroom.

Cultural studies in science education have become more important in latest years. Educators diagnosed the want to remember the numerous cultural backgrounds of college students so that it will sell science literacy and understanding. This systematic review targets to offer an outline of the contemporary studies on cultural studies in science education highlighting key issues and findings from relevant studies.

Overall, cultural studies in science education are an unexpectedly evolving subject encompassing a huge variety of studies regions and views. From inspecting the cultural elements that form science learning experiences, to incorporating cultural understanding and views into science curricula and pedagogy, the look at of cultural research in science education has the capacity to noticeably effect the sphere of technological know-how training and sell extra equitable and inclusive science learning possibilities for all students.

This article explores how cultural studies changed its nature during the last five decades around science education. The purpose of this all-embracing systematic study is to identify, analyze and establish main cultural trends and changes in the field of science and culture integration at educational institutions. The aim of the paper is to look at how cultural perspectives have shaped pedagogical styles, curricula and even the general discourse in science education over a period spanning from 1973 to 2023. Thus, the problem statement emphasizes the importance of comprehending cultural studies evolution within this context providing ideas, which may contribute to prospective investigations/policy/practices in science education promoting both an integrative and culturally sensitive knowledge environment.

LITERATURE REVIEW

The significance of cultural studies in science education changed into emphasized with the aid of using different researchers. Carlone and Johnson (2007) stated the need to understand the scientific experiences of underrepresented groups in science, such as women of color, and the ways in which scientific identity is formed. Wong and Hodson (2010) argued that cultural studies in science education can help bridge the gap between science as a discipline and the wider society, by examining the ways in which science is represented in popular culture and media. Lee et al. (2013) suggested

that cultural studies in science education were particularly relevant for English language learners facing additional linguistic and cultural barriers to understanding science content. Overall, cultural studies in science education gives a framework for significantly inspecting the cultural elements impacting technology coaching and learning, and for promoting equitable and inclusive science education for all students.

Recent research in cultural studies in science education has also explored the intersection of science education with other disciplines such as sociology, anthropology, and history. Barton and Tan (2010) draw on sociocultural theories to explore how identity and agency shape science learning experiences in their study of science learning among urban youth. Driver et al. (2000) utilized historical accounts of scientific argumentation to establish norms for scientific argumentation in classrooms. Xie et al. (2015) examined the role of project-based learning in promoting STEM education among middle school students, drawing on research from both science education and social psychology. These interdisciplinary approaches show the complexity of cultural studies in science education and highlight the need for collaboration across disciplines to better understand the cultural factors shaping science teaching and learning.

In addition to inspecting cultural elements in science education, latest studies have additionally centered on how cultural research can tell the improvement of science curriculum and pedagogy. For example, Jegede and Aikenhead (1999) argued for the incorporation of Indigenous understanding and views in science education, so one can sell a greater inclusive and holistic expertise of science. Buxton et al. (2008) explored the usage of cultural artifacts and practices in science classrooms including the usage of Chinese calligraphy to train scientific principles. Meanwhile, Brown and Crippen (2016) investigated the effect of culturally responsive teaching techniques on scholar engagement and fulfillment in science. This research established the capability of cultural research in science to tell the improvement of greater powerful and equitable science curricula and pedagogies.

Gay (2013) emphasized the importance of culturally responsive teaching involved in adapting teaching practices to the cultural backgrounds and experiences of students. Culturally responsive teaching is essential for promoting educational equity and developing a deeper understanding of the cultural and linguistic diversity of the students. Keys and Bryan (2001) concluded that

inquiry-based learning could help students connect science teaching to their daily life and own cultural experiences.

Research Questions

This systematic review focuses on studies related to the cultural studies in science education from 1973 to 2023 and the following six research questions (RQs) were investigated:

- RQ1.** What were the annual changes of the cultural studies in science education research?
- RQ2.** How does the distribution of the number of the document count in terms of author's name?
- RQ3.** How is the distribution of the documents by country?
- RQ4.** How is the distribution of most productive journals publishing articles related to the cultural studies in science education?
- RQ5.** How is distribution of the most cited articles related to cultural studies in science education?
- RQ6.** How is the distribution of the most preferred research design for articles related to cultural studies in science education?

METHOD

In this study, a systematic review with content analysis was used as a method to answer RQs. Goktas et al. (2012) defined content analysis used in systematic review as hybrid of statistical formalism and the qualitative analysis of the materials. Petticrew and Roberts (2006) developed guidelines to conduct a systematic content analysis, as follows:

- (1) problem formulation,
- (2) literature search,
- (3) data evaluation, and
- (4) analysis and interpretation.

The purpose of this study is to review systematically using content analysis related to the cultural studies in science education. To conduct this review, we searched the Scopus database using the following keywords: cultural studies, science education, chemistry, physics, biology education, learning, teacher and students. We included only articles published in peer-reviewed journals between 1973 and 2023 focusing on cultural studies in science education. A total of 277 articles were selected for review and a content analysis was conducted to identify key findings and trends in the literature.

Data Collection

The Scopus database scanned with using key-words (TITLE-ABS-KEY ("cultural studies") AND TITLE-ABS-KEY ("science") OR TITLE-ABS-KEY ("chemistry") OR TITLE-ABS-KEY ("physics") OR TITLE-ABS-KEY

("biology") AND TITLE-ABS-KEY ("education") OR TITLE-ABS-KEY ("learning") OR TITLE-ABS-KEY ("teachers") OR TITLE-ABS-KEY ("students") and 796 documents were found in initial search between 1973-2023 years. The review search was limited to only peer reviewed journal articles and 290 articles were found. After this scan, the search was restricted to free access and full-text articles and finally 277 articles were identified. These 277 articles were analyzed according to RQs.

In designing the data collection process, there was an attempt to cover as many scholarly sources as possible. A special searching strategy was designed to ensure the use of various academic databases, online repositories, and appropriate periodicals. The search words included concepts in cultural studies in the realm of science education deliberately to show this variety. In addition, the inclusion criteria allowed the selection of relevant and high-quality articles. The data was collected by screening potential thousands of them for later selecting only those studies meeting predetermined criteria. A more systematic way of collecting data is used as this means the conclusions derived from the study were made in a strong and sound manner from an adequate survey of the literature representing half a century of cultural studies within the science education sphere.

Data Analysis

This study concentrated on cultural studies in science education articles published between 1973-2023 years ago. All articles meeting criteria were analyzed with respect to annual accounts, number of articles by authors, distribution of articles by country, most productive journals, most cited articles, and most preferred research methods. Descriptive statistical techniques were used to represent the results of the content analysis. The Scopus database program was used to present the mapping of the annual accounts, number of articles by authors, distribution of articles by country, most productive journals, most cited articles and most preferred research methods for systematic review analysis.

The article was also characterized by a thorough method in data analysis alongside thorough collection of the data. These articles satisfying the determined criteria underwent thorough content analysis. To clarify the results, descriptive statistics were applied. Through statistical analysis, it was possible to observe trends, patterns, and changes that had occurred within science education relative to cultural studies for the fifty years under study. Additionally, Scopus offered a database program that enabled me to produce visual maps and other graphic presentations portraying yearly publication trends, author's patterns, journal dominance, global geographical distribution, citations network as well as common methods of research. The adoption of this data analysis technique rendered the

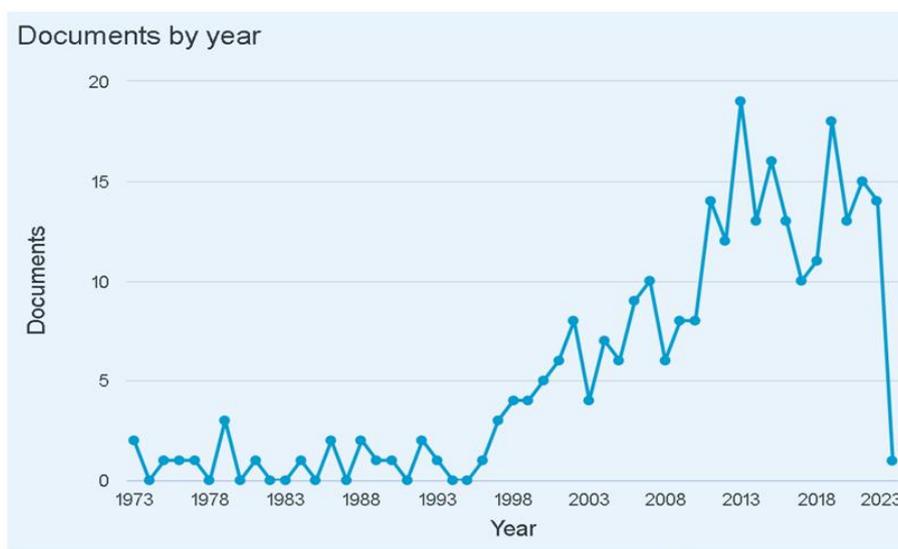


Figure 1. Frequency of publications in cultural studies in science education (Source: Authors’ own elaboration)

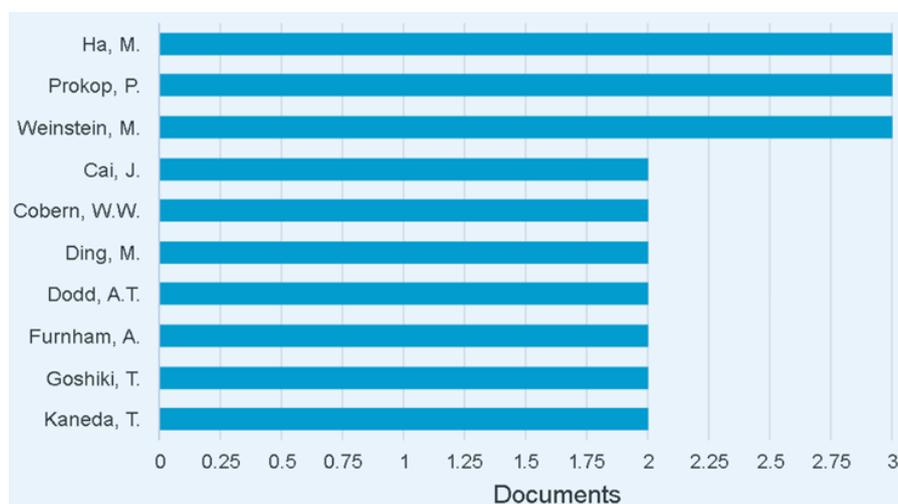


Figure 2. Distribution regarding number of articles by author (Source: Authors’ own elaboration)

study’s conclusions and findings evidence based as well as presenting them visually thus making it easy for the presentation of findings of the systematic review

FINDINGS

Annual Accounts of Articles

The annual accounts of these publications can be found in Figure 1. There are numerous articles that relate to the science education learning environment, with the majority of them having been recently published in the year 2021. It was found to be slightly higher than the general growth rate of scientific publications. A study conducted using the Scopus database has revealed that there has been a gradual increase in research articles about cultural studies in science education from 1973 till date. Starting with just two publications in 1973, it reached a count of over 21 annually by 2013. Additionally, the growth rate of publications related to cultural studies in science education is marginally higher

compared to the general growth rate of scientific publications listed on Scopus. The number of publications over time has not followed a consistent pattern, with periods of both faster and slower growth. From 1996 to 2002, the rate of publications increased annually, but from 2003 to 2023, the growth rate fluctuated between slowing down and positively accelerating. The publications indicate an increasing fascination and acknowledgement of the significance of cultural studies in scientific education investigation, along with the development of more proficient research techniques and resources that have allowed researchers to investigate this field more extensively.

Number of Articles by Authors

The distribution regarding the number of articles by authors on cultural studies in science education research has changed over time from 1973 to 2023. Three authors have three papers, 20 authors have two papers, and the rest of each have one paper, as can be seen in Figure 2.

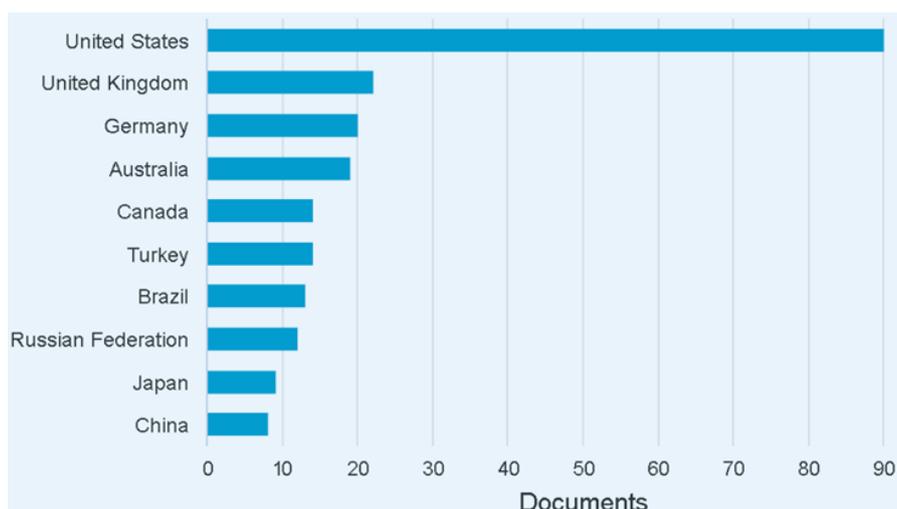


Figure 3. Distribution of articles by country (Source: Authors’ own elaboration)

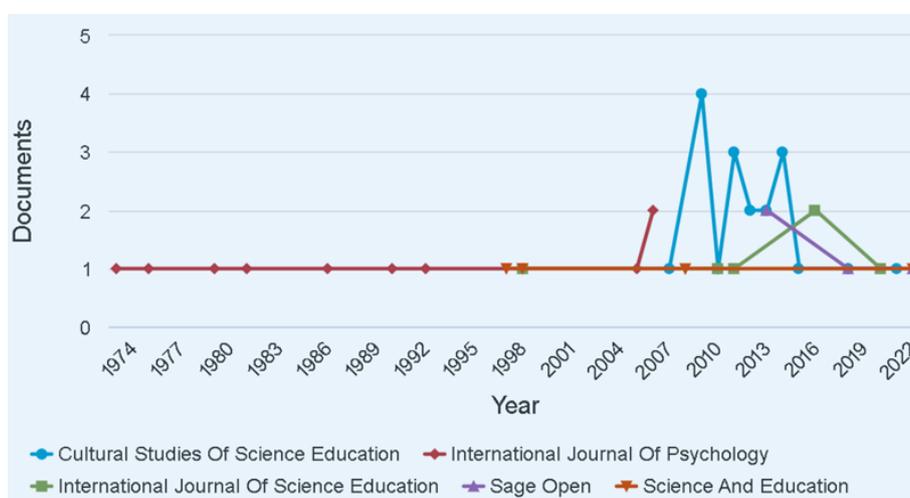


Figure 4. Distribution of most productive journals (Source: Authors’ own elaboration)

Distribution of Articles by Country

Analysis of the authors’ showed that the United States (USA), the United Kingdom (UK), and Germany were the most prolific producers of articles on the subject. Analysis revealed that most articles come from countries such as USA, UK, and Germany, while interest in this area is growing in countries such as Australia, Canada, and Turkey. This showed the global reach of research in science pedagogy and cultural studies, as shown by distribution of articles by country (Figure 3).

Distribution of Most Productive Journals

Scientific journals that publish articles on cultural studies in science education are critical in advancing our comprehension of how cultural aspects influence learning and teaching of science. With these journals, researchers and educators have a means to disseminate their insights, experiences, and empirical findings related to cultural studies in science education. Figure 4 provides evidence of Cultural Studies of Science Education, International Journal of Science Education, International Journal of Psychology, and Science and

Education being the most productive journals in this field. Through their publications, these journals contribute to the development of theoretical frameworks, research methodologies, and pedagogical approaches that are culturally responsive and inclusive. A systematic analysis of these journals can reveal important trends, patterns, and gaps in the field of cultural studies in science education and inform future research directions and priorities.

Distribution of Most Cited Articles

The distribution of the most cited works in the field of “cultural studies in science education” indicates interdisciplinary interest and influence. While many frequently cited articles have been published in science education journals, others have been published in teaching and teacher education or cultural journals. In general, the distribution of the most cited works underscores the interdisciplinary and global nature of cultural studies research in science education. The most cited articles related to cultural studies in science education can be seen in Table 1.

Table 1. Most cited articles related to cultural studies in science education

Reference	Title	Journal	Citations
Nagengast and Marsh (2012)	Big fish in little ponds aspire more: Mediation and cross-cultural generalizability of school-average ability effects on self-concept and career aspirations in science	Journal of Educational Psychology	160
Wang (2001)	Contexts of mentoring and opportunities for learning to teach: A comparative study of mentoring practice	Teaching and Teacher Education	120
Schnabel et al. (2002)	Parental influence on students' educational choices in the United States and Germany: Different ramifications—Same effect?	Journal of Vocational Behavior	106
Martin (2004)	An emerging research framework for studying informal learning and schools	Science Education	74
Chiu (2007)	Families, economies, cultures, and science achievement in 41 countries: Country-, school-, and student-level analyses	Journal of Family Psychology	73
Kim and Nehm (2011)	A cross-cultural comparison of Korean and American science teachers' views of evolution and the nature of science	International Journal of Science Education	66
Carter (2005)	Globalization and science education: Rethinking science education reforms	Journal of Research in Science Teaching	63
Bazzul (2012)	Neoliberal ideology, global capitalism, and science education: Engaging the question of subjectivity	Cultural Studies of Science Education	44
Chambliss and Calfee (1989)	Designing science textbooks to enhance student's understanding	Educational Psychologist	44
Guo et al. (2018)	Cross-cultural generalizability of social and dimensional comparison effects on reading, math, and science self-concepts for primary school students using the combined PIRLS and TIMSS data	Learning and Instruction	37

Table 2. Distribution of most preferred research methods

Type of research methods	Number of studies (n)	Percentage of studies (%)
Quantitative	106	36.55
Qualitative	84	28.97
Mixed (quantitative + qualitative)	95	32.76
Non-empirical	5	1.72

Distribution of Most Preferred Research Designs

The distribution of the most preferred research design for articles related to cultural studies in science education was categorized as quantitative, qualitative, and mixed studies. Qualitative research method was used in 106 of the studies, so the most popular research design was quantitative research method. 95 of the studies were mixed (qualitative and quantitative method together) and this research method consisted of 32.80% of all studies. The other research method was qualitative related to cultural studies in science education. 89 of the studies were in qualitative research methods. Finally, these distributions were shown in **Table 2**.

DISCUSSION & CONCLUSIONS

While the review studies in the literature mostly focus on the culture of science education or a specific dimension of cultural studies in science education (Baker & Taylor, 1995; Barton & Yang, 2000; Brotman & Moore, 2008; Carter, 2005, 2008; Garaway, 1994; Gondwe & Longnecker, 2015; Hasse & Sinding, 2012; Isa et al., 2022;

Jegede, 1997; Lee, 2001; Pang et al., 2014; Parsons & Carlone, 2013); cultural studies in science education were approached in a broader and more encompassing dimension and a systematic review method was preferred by using scope analysis in this study.

The content analysis findings of articles related to cultural studies in science education published in journals indexed in the Scopus database were reported in this study. The results revealed that cultural studies in science education research were not continually changed from 1973 to 2023 according to the Scopus database. The reasons for this could be that the subject was general, multidimensional, and perceived as a broader subject. The results showed that cultural studies research in science education has increased significantly in recent years. Most articles published between 2010 and 2023 indicate that the topic is gaining momentum.

Considering the authors who have published the most articles, it is seen that Weinstein, one of the authors with three articles, has two articles with a single author, while Klein, one of the authors with two articles, has a single author in these articles. When it is determined that

all articles other than this are multi-authored, it is noteworthy that multi-authored articles constitute the majority.

This study showed that the country publishing most articles related to cultural studies in science education was USA. Most of the studies were conducted in developed countries, with USA, UK, and Germany being the most represented countries.

When the most productive academic journals are scanned, it is seen that the journal named "Cultural Studies of Science Education" takes the lead in accordance with the title of this study. Other productive journals are the International Journal of Science Education and Science and Education, which have a wide impact on science education.

In terms of the most cited articles, the first article with 160 citations was published by Nagengast and Marsh (2012) in a journal called "Journal of Educational Psychology". The journals with the most cited articles are multidisciplinary journals, although they vary.

The most common research methods were quantitative studies (36.55%), followed by mixed studies (32.76%), qualitative studies (28.97%), and nonempirical studies (1.72%).

The present study showed trends of articles related to cultural studies in science education published in journals indexed in the Scopus database. Following implications proposed for future research and practice in cultural studies in science education based on the findings of this review. First, researchers should continue to explore the ways in which students' cultural backgrounds and experiences impact their attitudes and engagement toward science education. Further research is needed to understand how cultural factors can be incorporated into science curriculum and instruction to enhance student learning outcomes. Second, educators should strive to create culturally responsive science education recognizing and addressing the cultural and social barriers that impede students' access and participation in science. This study is limited to articles published in journals indexed in the Scopus database.

Thus, overall, this systematic review has made an elaborate presentation about the dynamics taking place in cultural studies research in science education from 1973 till today. As earlier research had concentrated on certain aspects of cultural studies in science education, the present review used a more comprehensive strategy and surveyed numerous articles on the topic. The results show that there has been increasing research output on cultural perspectives in science education over the last years; signifying growing interest in this area of study. This observation would seemingly suggest that multi-authored articles rule, thus a cooperative path of investigation among various dimensions of fields. In addition, it shows that cultural studies play a critical role

in framing out the pedagogy of science within the global sphere of research.

These findings are discussed to reveal that cultural studies are a dynamic field in science education. This is evident by the tenfold increase in the research output of the past 10 years, which shows growing awareness about how cultural issues influence science education. The emerging scene demands further investigation on how a student' cultural background influences his or her participation in science education. This includes also adding consideration for culture into science curriculum and instruction to build a more responsive and multicultural learning environment. Teachers ought to take culture into account as they endeavor to remove all barriers that have been impacting students' learning of and access to science education.

This study has significant implications for current cultural studies in science educational fields as well as future research and practical aspects. It is necessary for researchers to conduct a study that will unveil how cultural background influences students' perception towards learning science subjects and its engagement. Science educators ought to attempt to create culturally responsive learning environments, acknowledge or mitigate culturally and social barriers that deny opportunity for science access. This current study targeted articles that are present in the Scopus database, but future studies should have a wide outlook in terms of information sources to capture and get a better understanding of the ever-changing patterns is current cultural studies in science education.

Author contributions: All authors have sufficiently contributed to the study and agreed with the results and conclusions.

Funding: No funding source is reported for this study.

Ethical statement: Authors stated that the study did not require ethical approval since it is based on existing literature.

Declaration of interest: No conflict of interest is declared by authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

REFERENCES

- Allchin, D. (2014). From science studies to scientific literacy: A view from the classroom. *Science & Education, 23*, 1911-1932. <https://doi.org/10.1007/s11191-013-9672-8>
- Baker, D., & Taylor, P. C. (1995). The effect of culture on the learning of science in non-western countries: The results of an integrated research review. *International Journal of Science Education, 17*(6), 695-704. <https://doi.org/10.1080/0950069950170602>
- Barton, A. C., & Tan, E. (2010). We be burnin'! Agency, identity, and science learning. *Journal of the Learning Sciences, 19*(2), 187-229. <https://doi.org/10.1080/10508400903530044>

- Barton, A. C., & Yang, K. (2000). The culture of power and science education: Learning from Miguel. *Journal of Research in Science Teaching*, 37(8), 871-889. [https://doi.org/10.1002/1098-2736\(200010\)37:8<871::AID-TEA7>3.0.CO;2-9](https://doi.org/10.1002/1098-2736(200010)37:8<871::AID-TEA7>3.0.CO;2-9)
- Bazzul, J. (2012). Neoliberal ideology, global capitalism, and science education: Engaging the question of subjectivity. *Cultural Studies of Science Education*, 7, 1001-1020. <https://doi.org/10.1007/s11422-012-9413-3>
- Brotman, J. S., & Moore, F. M. (2008). Girls and science: A review of four themes in the science education literature. *Journal of Research in Science Teaching*, 45(9), 971-1002. <https://doi.org/10.1002/tea.20241>
- Brown, J. C., & Crippen, K. J. (2016). Designing for culturally responsive science education through professional development. *International Journal of Science Education*, 38(3), 470-492. <https://doi.org/10.1080/09500693.2015.1136756>
- Buxton, C., Lee, O., & Santau, A. (2008). Promoting science among English language learners: Professional development for today's culturally and linguistically diverse classrooms. *Journal of Science Teacher Education*, 19(5), 495-511. <https://doi.org/10.1007/s10972-008-9103-x>
- Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching*, 44(8), 1187-1218. <https://doi.org/10.1002/tea.20237>
- Carter, L. (2005). Globalization and science education: Rethinking science education reforms. *Journal of Research in Science Teaching*, 42(5), 561-580. <https://doi.org/10.1002/tea.20066>
- Carter, L. (2008). Sociocultural influences on science education: Innovation for contemporary times. *Science Education*, 92(1), 165-181. <https://doi.org/10.1002/sce.20228>
- Chambliss, M. J., & Calfee, R. C. (1989). Designing science textbooks to enhance student's understanding. *Educational Psychologist*, 24(3), 307-322. https://doi.org/10.1207/s15326985ep2403_5
- Chiu, M. M. (2007). Families, economies, cultures, and science achievement in 41 countries: Country-, school-, and student-level analyses. *Journal of Family Psychology*, 21(3), 510-519. <https://doi.org/10.1037/0893-3200.21.3.510>
- Dimick, A. S. (2012). Student empowerment in an environmental science classroom: Toward a framework for social justice science education. *Science Education*, 96(6), 990-1012. <https://doi.org/10.1002/sce.21035>
- Driver, R., Newton, P., & Osborne, J. (2000). Establishing the norms of scientific argumentation in classrooms. *Science Education*, 84(3), 287-312. [https://doi.org/10.1002/\(SICI\)1098-237X\(200005\)84:3<287::AID-SCE1>3.0.CO;2-A](https://doi.org/10.1002/(SICI)1098-237X(200005)84:3<287::AID-SCE1>3.0.CO;2-A)
- Garaway, G. B. (1994). Language, culture, and attitude in mathematics and science learning: A review of the literature. *Journal of Research & Development in Education*, 27(2), 102-111.
- Gay, G. (2013). Teaching to and through cultural diversity. *Curriculum Inquiry*, 43(1), 48-70. <https://doi.org/10.1111/curi.12002>
- Goktas, Y., Hasancebi, F., Varisoglu, B., Akcay, A., Bayrak, N., Baran, M., & Sozbilir, M. (2012). Trends in educational research in Turkey: A content analysis. *Educational Sciences: Theory and Practice*, 12(1), 455-460.
- Gondwe, M., & Longnecker, N. (2015). Scientific and cultural knowledge in intercultural science education: Student perceptions of common ground. *Research in Science Education*, 45, 117-147. <https://doi.org/10.1007/s11165-014-9416-z>
- Guo, J., Marsh, H. W., Parker, P. D., & Dicke, T. (2018). Cross-cultural generalizability of social and dimensional comparison effects on reading, math, and science self-concepts for primary school students using the combined PIRLS and TIMSS data. *Learning and Instruction*, 58, 210-219. <https://doi.org/10.1016/j.learninstruc.2018.07.007>
- Hasse, C., & Sinding, A. B. (2012). The cultural context of science education. In D. Jorde, & J. Dillon (Eds.), *Science education research and practice in Europe* (pp. 237-252). Brill. https://doi.org/10.1007/978-94-6091-900-8_10
- Isa, I. M. M., Bunyamin, M. A. H., & Phang, F. A. (2022). Bridging culture and science education: Implications for research and practice. *International Journal of Learning, Teaching and Educational Research*, 21(10), 362-380. <https://doi.org/10.26803/ijlter.21.10.20>
- Jegede, O. J. (1997). School science and the development of scientific culture: A review of contemporary science education in Africa. *International Journal of Science Education*, 19(1), 1-20. <https://doi.org/10.1080/0950069970190101>
- Jegede, O. J., & Aikenhead, G. S. (1999). Transcending cultural borders: Implications for science teaching. *Research in Science & Technological Education*, 17(1), 45-66. [https://doi.org/10.1002/\(SICI\)1098-2736\(199903\)36:3<269::AID-TEA3>3.0.CO;2-T](https://doi.org/10.1002/(SICI)1098-2736(199903)36:3<269::AID-TEA3>3.0.CO;2-T)
- Keys, C. W., & Bryan, L. A. (2001). Co-constructing inquiry-based science with teachers: Essential research for lasting reform. *Journal of Research in Science Teaching*, 38(6), 631-645. <https://doi.org/10.1002/tea.1023>
- Kim, S. Y., & Nehm, R. H. (2011). A cross-cultural comparison of Korean and American science teachers' views of evolution and the nature of

- science. *International Journal of Science Education*, 33(2), 197-227. <https://doi.org/10.1080/09500690903563819>
- Kinslow, A. T., Sadler, T. D., & Nguyen, H. T. (2019). Socio-scientific reasoning and environmental literacy in a field-based ecology class. *Environmental Education Research*, 25(3), 388-410. <https://doi.org/10.1080/13504622.2018.1442418>
- Lee, O. (2001). Culture and language in science education: What do we know and what do we need to know? *Journal of Research in Science Teaching*, 38(5), 499-501. <https://doi.org/10.1002/tea.1015>
- Lee, O., Quinn, H., & Valdés, G. (2013). Science and language for English language learners in relation to next generation science standards and with implications for common core state standards for English language arts and mathematics. *Educational Researcher*, 42(4), 223-233. <https://doi.org/10.3102/0013189X13480524>
- Martin, L. M. (2004). An emerging research framework for studying informal learning and schools. *Science Education*, 88(S1), S71-S82. <https://doi.org/10.1002/sce.20020>
- Nagengast, B., & Marsh, H. W. (2012). Big fish in little ponds aspire more: Mediation and cross-cultural generalizability of school-average ability effects on self-concept and career aspirations in science. *Journal of Educational Psychology*, 104(4), 1033-1053. <https://doi.org/10.1037/a0027697>
- Pang, V. O., Lafferty, K. E., Pang, J. M., Griswold, J., & Oser, R. (2014). Culture matters in science education. *Science and Children*, 51(5), 44. https://doi.org/10.2505/4/sc14_051_05_44
- Parsons, E. C., & Carlone, H. B. (2013). Culture and science education in the 21st century: Extending and making the cultural box more inclusive. *Journal of Research in Science Teaching*, 50(1), 1-11. <https://doi.org/10.1002/tea.21068>
- Petticrew, M., & Roberts, H. (2006). Exploring heterogeneity and publication bias. In M. Petticrew, & H. Roberts (Eds.), *Systematic reviews in the social sciences: A practical guide* (pp. 215-246). Blackwell Publishing. <https://doi.org/10.1002/9780470754887.ch7>
- Schnabel, K. U., Alfeld, C., Eccles, J. S., Köller, O., & Baumert, J. (2002). Parental influence on students' educational choices in the United States and Germany: Different ramifications-Same effect? *Journal of Vocational Behavior*, 60(2), 178-198. <https://doi.org/10.1006/jvbe.2001.1863>
- Wang, J. (2001). Contexts of mentoring and opportunities for learning to teach: A comparative study of mentoring practice. *Teaching and Teacher Education*, 17(1), 51-73. [https://doi.org/10.1016/S0742-051X\(00\)00038-X](https://doi.org/10.1016/S0742-051X(00)00038-X)
- Wong, S. L., & Hodson, D. (2010). More from the horse's mouth: What scientists say about science as a social practice. *International Journal of Science Education*, 32(11), 1431-1463. <https://doi.org/10.1080/09500690903104465>
- Xie, Y., Fang, M., & Shauman, K. (2015). STEM education. *Annual Review of Sociology*, 41, 331-357. <https://doi.org/10.1146/annurev-soc-071312-145659>

<https://www.ejmste.com>