Culturally Responsive Teaching in Science Education and its Relationship with Technopreneurship

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ABSTRACT

Culturally Responsive Teaching (CRT) has been widely recognized for its positive impact on teaching practices, yet its foundational concepts and relationship with students cultural backgrounds, diversity, and specific implementation in science education to foster technopreneurship remain underexplored. **This study addresses this gap** by systematically identifying and constructing the concept of CRT and its integration with technopreneurship in science education using the PRISMA systematic literature review method. Data were collected from reputable international and national journal articles published between 2018 and 2023. **The findings** reveal that CRT in science education serves as a framework for teaching that integrates students knowledge, experiences, cultural backgrounds, and environments with scientific methods while respecting individual diversity. Effective implementation requires teachers commitment and skills to create inclusive learning environments tailored to diverse student characteristics. Importantly, CRT inspires students to design technological innovations that address cultural challenges, thereby fostering entrepreneurial interest and capabilities. **This study contributes** novel insights into how CRT in science education bridges cultural understanding and technopreneurship development, offering a transformative approach to science teaching that aligns with global and local educational needs.

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1. INTRODUCTION

The dynamics of 21st-century development and advancements in science and technology significantly impact the competencies required of the younger generation [1–5]. Education goal has expanded beyond achieving scientific competence, it now aims to produce individuals capable of becoming agents of change who possess character and cultural awareness, ready to face future challenges [6–9].

This necessitates a transformation in education, prioritizing both cognitive skills and the development of values and lifelong learning attitudes [10]. A significant challenge in modern education lies in addressing the diversity of student backgrounds, which encompasses various cultural, linguistic, and socioeconomic dimensions [11–14]. Differences in these aspects often correlate with disparities in student achievement, particularly among minority, immigrant, or economically disadvantaged groups [15, 16]. Teachers must understand and adapt to this diversity by designing learning experiences that are inclusive and culturally relevant, enabling all students to participate fully in the learning process [17, 18].

Transformative learning practices require integrating complex, real-world issues that resonate with student experiences and cultural contexts, fostering emotional and intellectual engagement [19]. For instance, involving families in discussions on cultural and societal issues can strengthen relationships and bridge gaps between home and school [20]. This approach aligns with the principles of CRT, which emphasizes the importance of teacher competencies in creating inclusive classrooms that respect and leverage student cultural identities [12, 21].

CRT has shown a positive impact on learning outcomes and character building [22–24]. It highlights the role of students as active participants in co-constructing knowledge, emphasizing the interplay between individual experiences and broader societal narratives [25]. Despite its potential, research on CRT remains limited, particularly in its application within science education. Most studies focus on enhancing teacher understanding of CRT but do not thoroughly explore its broader conceptualization or its integration with contemporary educational priorities like technopreneurship [26].

Technopreneurship, the intersection of technology and entrepreneurship, plays a critical role in addressing global challenges such as climate change and economic disparities. It equips students, particularly those from marginalized backgrounds, with innovative and entrepreneurial skills essential for thriving in a technology-driven economy [27, 28]. Integrating CRT into science education with a focus on technopreneurship offers a novel approach to fostering inclusivity and preparing students for future challenges. Therefore, this study aims to:

- Analyze CRT research trends.
- Develop a comprehensive concept of CRT within the context of science education and examine the implementation of CRT in science education.
- Explore the connection between CRT and technopreneurship.

This research is significant for teachers and researchers as it provides insights into developing CRT-based models and implementing them in science education to achieve sustainable development goals. By addressing the intersection of culture, education, and technology, this study contributes to creating equitable and inclusive learning environments while fostering innovation and global citizenship [29–31].

2. METHODOLOGY

The research method uses a qualitative approach in the form of a literature study, namely a Systematic Literature Review (SLR) using PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) technique [32, 33]. Systematic literature review is a way of identifying, evaluating and interpreting research sources that are in accordance with the formulation of the problem or research topic area to be reviewed using literature studies. The characteristics of SLR are very suitable for achieving research objectives.

SLR stages are divided into three, namely Planning, Conducting and Reporting. At the Planning stage, planning and identification are carried out starting with transforming a problem into a research question. Based on these research questions, researchers conducted the second stage, namely Conducting.The implementation stage is divided into several sub-stages, namely identification, screening, eligibility, and inclusion. In the identification stage, the process of searching for literature sources using the keywords ”Culturally Responsive Teaching” OR ”CRT” AND ”Science” AND ”Education” with English and Indonesian versions through the search media from Scopus and Google Scholar indexing media. The limitation of the journal publication year, set between 2018 and 2023, ensured a focus on recent and relevant research within the scope of CRT in Science Education. An initial search across multiple platforms yielded a total of 837 articles, with 697 sourced from Google Scholar and 140 from Scopus. This comprehensive approach highlights the breadth of available literature while emphasizing the importance of using multiple databases to capture a diverse range of studies. The combined dataset provided a robust foundation for further screening and analysis, enabling the identification of high-quality articles that align with the research objectives.

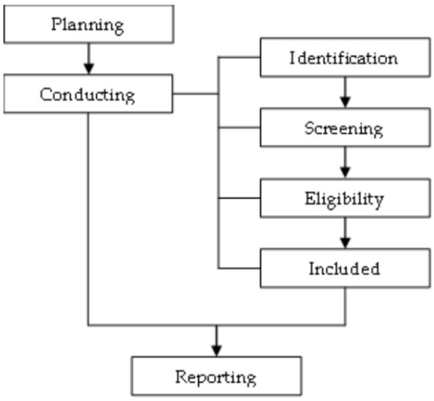

Figure 1. SLR Research Stages

Furthermore, the screening stage is carried out starting from the title, keyword review and abstract according to the parameters determined by the researcher. The article titles and content were reviewed to ensure all exclusion requirements were met and relevant to this study [34]. Screening parameters are articles in the range of 2018-2023, articles containing CRT keywords and articles on educational studies. At this stage, 137 articles were categorized and 689 were discarded.

Next step is eligibility, at the Eligibility stage, researchers conducted inclusion and exclusion criteria for the entire contents of journal articles. The studies were analysed on the basis of full-text screening if they met selection criteria [35, 36]. Articles selected were those that outlined the definition of CRT, the implementation of CRT and focused on the scope of science. Based on this stage, there were 16 articles that met the eligibility criteria.

The next stage of the research process involved a detailed review and analysis of the 16 selected articles using bibliometric analysis. This analysis aimed to uncover emerging trends and gaps in Critical Race Theory (CRT) research within the scope of science education. By employing VOSviewer, a tool designed for mapping and visualizing scientific literature, the analysis provided insights into the topics that have been thoroughly explored and those that remain under-researched. These findings offered valuable opportunities for identifying new areas for further study, particularly in expanding the application of CRT in science education contexts.

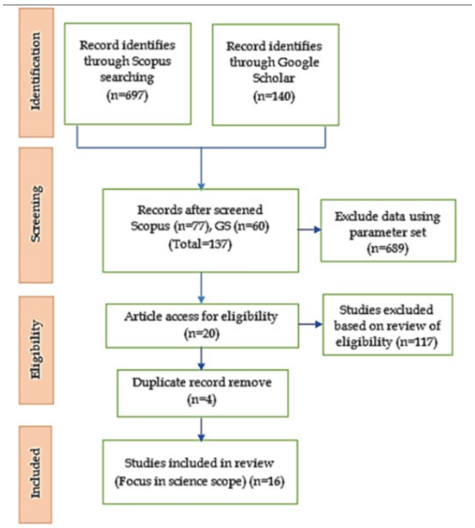

Figure 2. PRISMA Flowchart to Show Search Results

This systematic approach not only ensured the validity and reliability of the findings but also provided a robust framework for replicability in future studies. By combining bibliometric analysis with narrative synthesis, the research effectively bridged quantitative insights and qualitative interpretations. This integration offered a comprehensive perspective on CRT research trends within the field of science education, highlighting both well-explored areas and gaps that warrant further investigation. The narrative synthesis allowed for an in-depth and balanced explanation of the findings, ensuring that the research questions were addressed thoroughly.

The application of PRISMA techniques further enhanced the methodological rigor by providing a transparent and structured depiction of the article selection process and the criteria used. This clarity not only reinforced the credibility of the study but also paved the way for future researchers to build upon its findings. Figures 1 and Figure 2 play a crucial role in visually representing the stages of the SLR and the PRISMA techniques, emphasizing the studys dedication to transparency and methodological precision. Together, these efforts contribute significantly to the academic discourse, offering a solid foundation for innovative approaches and deeper exploration in CRT-related research.

The PRISMA flowchart in Figure 2 outlines the systematic process used for article selection. Initially, 697 records were identified from Scopus and 140 from Google Scholar, totaling 837. After screening, 77 records from Scopus and 60 from Google Scholar met the criteria, resulting in 137 eligible records. Following further filtering based on parameter sets and eligibility reviews, 689 studies were excluded. Four duplicate records were removed, leaving 16 studies focusing specifically on the science scope for inclusion in the review.

3. RESULT AND DISCUSSION

3.1. CRT Research Trends

Research trends in CRT from 2018 to 2023 were systematically analyzed using bibliometric techniques, with VOSviewer playing a crucial role in visualizing and interpreting the patterns and relationships within the field. The data collection process involved a comprehensive and methodical search across two prominent academic databases, Scopus and Google Scholar, which are widely regarded for their extensive repositories of scholarly work. This dual-database approach ensured that the review captured a broad spectrum of relevant literature, minimizing the risk of overlooking significant studies. From these searches, a total of 16 articles were identified as being highly relevant to CRT research, particularly in the context of Science Education. These articles were carefully reviewed to extract meaningful insights, trends, and contributions that have shaped the understanding of CRT within this domain.

The 16 selected articles underwent a meticulous evaluation process to identify key themes and highlight the research gaps that remain in the field. This process enabled the researchers to map out both the progress and limitations of CRT scholarship in Science Education over the specified period. To ensure clarity and accessibility, the identities and details of these articles were organized and summarized in Table **??**, which provides a detailed account of the studies reviewed. This table serves as a foundational reference for understanding the scope and focus of CRT research, offering readers an organized view of the literature while emphasizing its evolving impact on Science Education scholarship. By presenting the findings in a structured manner, this analysis not only highlights the significant contributions made by the selected studies but also points to opportunities for future research to further expand the boundaries of CRT in Science Education.

Table 1. Summary of Article Data Identity

Data Component	**Result**
Total Documents	16 articles
Year of Publication	2018 (2, 12.5%), 2019 (1, 6.25%),
	2020 (2, 12.5%), 2021 (6, 37.5%),
	2022 (5, 31.25%)
Indexer	SCOPUS Q1 (6, 37.5%)
	SCOPUS Q2 (1, 6.25%)
	SCOPUS Q3 (2, 12.5%)
	Sinta 2 (2, 12.5%)
	Sinta 4 (4, 25%)
	Google Scholar (1, 6.25%)

Type of Research	Case study (1, 6.25%)
	Qualitative case study (1, 6.25%)
	Experiments (2, 12.5%)
	Mixed (1, 6.25%)
	Qualitative descriptive (6, 37.5%)
	Descriptive (3, 18.75%)
	Research and Development (2, 12.5%)
Keywords/Variables associated with the CRT	Robotics, Game Design, STEM, Self-efficacy,
	Biology Teaching Assistants, Promoting Inclusive,
	General Chemistry, Inclusive Classrooms,
	Teaching Mathematics and Science,
	Urban Secondary Schools, Teachers Stories,
	Ethno Physics, Diverse Student Teacher Cohort,
	Ethno Chemistry, Chemistry Learning, Ethnosciences,
	Novice Teacher

The VOSviewer results from the data of 16 articles based on keywords are in the form of a visualization of CRT research trends in Science Education (Figure 3). After analysis, there are 8 clusters marked with colors such as red, blue, green, yellow, purple, pink and other colors. The clusters show that there is a relationship between one topic and another. The thickness of the connecting line indicates the strength of the topic area or keyword.

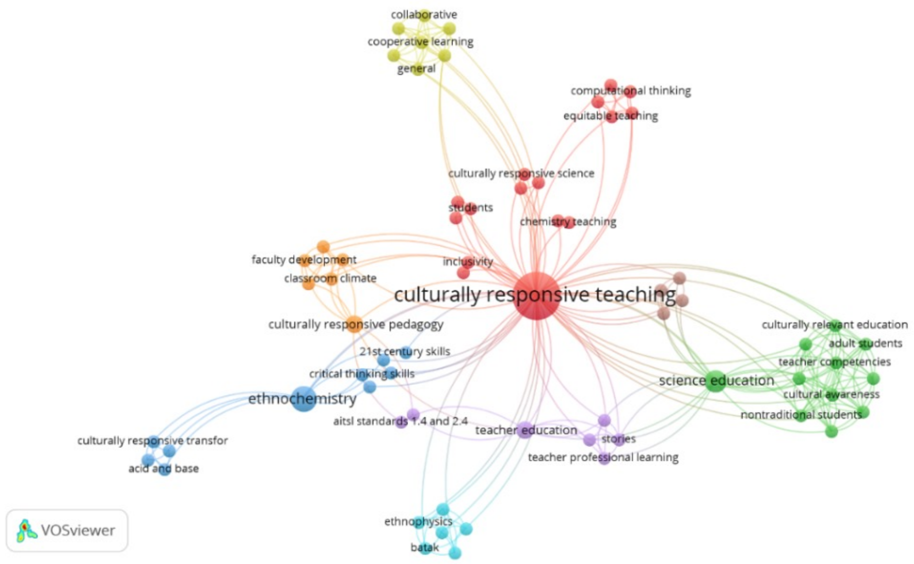

Figure 3. Visualization of CRT research in science education using VOSviewer

Based on the analysis of the 16 selected articles, it was found that the research studies that have been conducted are grouped into three parts, namely the knowledge, understanding and skills of teachers towards CRT, opinions and perceptions of learners towards CRT and implementation of CRT in learning. Studies related to teachers knowledge and understanding of CRT are needed to reveal the limits of teachers abilities based on their knowledge findings. [37] found teachers beliefs and attitudes improved after they understood CRT. Teachers considered that CRT holds great promise for engaging underserved learners such as rural learners [38]. Students cannot remove their habits and ways of life and bring them to the classroom so CRT is needed to facilitate learners with their own characteristics. Proper knowledge of CRT can motivate teachers to change their teaching practices in the classroom. The teaching and learning process carried out by teachers should condition the classroom according to the culture brought uniquely by students.

Teachers are very enthusiastic about this training so that it has a positive impact on the attitudes, knowledge and attitudes of teachers so that it motivates them to change classroom teaching practices. Through training or educational programs, teachers improve teaching skills that focus on building diverse student life experiences. Teachers also have access to the educational reality and more able to experience the problems occulting in practice of the education [39, 40].

The learning model most used by teachers is cross cultural communication [41]. So, that teachers must have confidence and cultivate cultural responsiveness in teaching diverse students. Teachers need to develop an understanding of cultural implications and minimize tensions that may arise due to each student differences. This aims to increase learners success in learning. By considering the character and culture of students, teachers can manage the classroom optimally.

More specifically, the study of CRT understanding and knowledge from teachers in science classes was researched [42]. This study summarizes the stories of teachers who cross cultural boundaries in implementing CRT in the classroom and teachers find that storytelling is one of the tools that can describe culture and build students thinking skills in linking fairy tales with the real world in science material. It is necessary to conduct research to identify and reconstruct local community science, which will be integrated into the science learning curriculum [43].

CRT knowledge has also been examined from learners perspectives. Students argue that in order for teachers to teach effectively to students who have diverse backgrounds, teachers need an understanding of the local culture of students and the impact of the culture brought by these students so that teachers can develop instructional designs to implement CRT type teaching [36]. Diverse perceptions of students character and cultural diversity and valuable opportunities to learn from and appreciate differences through discussion and collaboration between students. Students stated that it is important to understand and appreciate each other differences in order to learn together and share problems that may occur during learning so that it creates motivation and passion in learning. Proximity and good communication between students will minimize the problem of student gaps [34]. This can certainly reduce the chances of bullying practices in the school environment

3.2. CRT Concepts and Implementation in Science Education

Previous research defines CRT as limited to culture alone but this is wrong [24], because CRT not only considers culture but also other aspects such as background, language, characteristics, life habits, perspectives and cultural experiences of students in all aspects of learning [25, 44]. CRT research in science education defines CRT in several ways. The ideological foundation of CRT is caring that begins with personal and professional self-awareness. CRT has generally been defined in accordance with the concept proposed by the first originator of CRT, CRT as a teaching concept that uses cultural knowledge, backgrounds, previous experiences, life habits, performance styles of ethnically diverse students to make learning more relevant and effective for them. This proves that CRT considers the diversity of student characters and backgrounds and respects the culture that students bring to learning so that students get equal rights in learning [35, 43].

Science education is seen as an important aspect of contemporary culture because science can have an influence on the development of other sciences [45]. Science itself is the study of nature and the processes that occur in nature through a series of scientific processes. The concept of CRT in science education can be explained as a form of teaching that explores and constructs scientific knowledge from the basic knowledge, experience, culture and environment of students through scientific methods without ignoring the characteristics and background of students. Teaching is carried out according to the characteristics, abilities and learning needs of students so that there is justice in learning [16, 24, 25].

Science materials are taught through the exploration of basic knowledge and culture that students have or that is in the students environment. This is an effort to facilitate students in contextualized and humanized learning so that it is believed to increase knowledge, train skills and build student character. More specifically, CRT can improve academic achievement, develop cultural competence, train higher-order thinking skills, instill self-awareness of cultural competence in multicultural classrooms, build emotional and social development from cultural awareness and build students concern and involvement in relationships with others [42, 46, 47].

Science concepts can be linked to culture [48]. It is intended that by integrating students culture and background into science learning, students can recognize culture from the science side and science material can also be understood through examples raised from culture or student experiences. A lot of science content and context can be extracted from cultural sources and students environment so that students can reason more and trigger their thinking skills. By studying local culture and linking it with science materials, students are required to analyze, evaluate, and create various phenomena that occur with the concepts they learn in science learning. In addition, science materials that are integrated with culture can strengthen moral values and local culture and become a filter for negative influences from the globalization era [49–51].

CRT aligns with inquiry-based practices that engage students cultural backgrounds, enhancing their understanding of scientific concepts, discuss how inquiry-based practices can be integrated with students funds of knowledge through activities such as analyzing local environmental issues. This connection not only enriches their learning experience but also fosters a sense of relevance and applicability of STEM in their lives, potentially igniting interest in technopreneurship as students identify local problems that can be innovatively addressed. [52] emphasizes the complementarity of CRT and inquiry-based science education, advocating for equitable teaching practices that resonate with diverse learners. The research highlights that when teachers connect scientific concepts to students cultural contexts, they can empower students to see themselves as contributors to scientific discourse, thus promoting engagement in STEM fields and nurturing future technopreneurs. Additionally, the development of culturally responsive science and mathematics teaching models is crucial in creating inclusive learning environments. [53] illustrate how integrating students cultural artifacts and narratives into the curriculum can facilitate a more relatable learning experience, ultimately enhancing students engagement and problem-solving skills in technology-related fields.

Teacher preparedness is a critical factor in the successful implementation of CRT in science education. [54] argue that teacher education programs must better prepare candidates for culturally responsive instruction, particularly by enhancing their understanding of diversity and Otherness. Professional development activities that focus on CRT can significantly improve teachers ability to design lessons that are both culturally relevant and scientifically rigorous. [55] present a conceptual framework for integrated STEM education that underscores the necessity for professional development aimed at building teachers CRT self-efficacy. This framework not only improves instructional practices but also supports the nurturing of diverse student populations who are equipped for technopreneurship.

Schools that effectively implement culturally responsive practices can serve as valuable case studies for demonstrating the impact of CRT on student outcomes. For instance, [56] conducted a systematic review of instructional practices in secondary education that highlighted several exemplary schools where CRT has led to increased student engagement and performance in STEM subjects. These schools exemplify how culturally responsive practices can transform science education, making it more inclusive and engaging for all students. Moreover, the integration of Computational Thinking (CT) in STEM education, enriched by CRT, prepares students for future innovation. [57] discuss how robotics and game design contexts can be enhanced by incorporating cultural narratives, fostering a deeper connection to the material that can inspire students to pursue technopreneurship. Based on the research results, it was found that many CRT studies are limited because the application of students own culture and background in the classroom is contextual and the process must be situational so that it is difficult to be widely applied when dealing with ethnically diverse students [56, 58].

3.3. Linkage of CRT Concept to the Scope of Technopreneurship

In science learning, students are often faced with abstract science material so it is necessary to apply a learning model that can present science material actually to students [59]. One of the things that can be done is by linking science material with local culture and wisdom around students. Culture and local wisdom can be a source of learning that is close to students. One of the learning concepts that considers cultural background to be raised in learning is CRT. CRT can be combined with a project-based learning model that raises real-world problems to be solved through project activities [60]. Many real-world problems related to culture can be raised in learning so as to train students to solve problems [61]. Problems related to this culture can be sought for creative solutions that have the opportunity to become a form of creative product. Furthermore, these creative products can be sold and become a source of income for students [62].

Many problems are related to culture and local wisdom; for example, the traditional cooking process of food often causes problems such as cooking results that do not meet the characteristics and original flavors so that traditional food cannot be marketed optimally. One example of a problem in the traditional food cooking process is the cooking of putu bamboo cake. If cooked in large quantities and larger sizes, the center of putu bamboo cannot be cooked perfectly [63]. This problem can be a project topic in science learning that is solved by applying the CRT concept. Science learning with the CRT concept is expected to improve mastery of science concepts and awaken students thinking skills [64].

The CRT concept in science education can encourage students to develop technological innovations that are relevant to the scope of technopreneurship. The CRT concept teaches students to be able to accept the differences that exist so that students are open-minded in facing problems in their lives [65]. Culture-related problems, such as bamboo putu cooking problems, can be solved with project activities [62, 65]. Students can design innovative cooking tools to cook putu bamboo in large quantities and larger sizes so that it has the potential to open a business world for students. Student innovation products still strive for putu bamboo according to their characteristics. It is because the CRT concept makes students still try to maintain their cultural identity despite the development of increasingly sophisticated technology [66, 67].

The foundation of CRT lies in its ability to engage students by making learning relevant to their cultural contexts. [68] emphasize the importance of adapting educational practices to the cultural backgrounds of students, which can lead to improved engagement in technology-related fields. This adaptability fosters a learning environment where students feel valued and understood, thus enhancing their motivation to participate in technological projects [68]. Moreover, research by [69] indicates that leveraging social media tools, such as Facebook and blogs, can enhance student engagement by allowing students to discuss culturally relevant topics. This integration of technology not only reinforces CRT principles but also provides a platform for collaborative learning. For instance, using Facebook groups to facilitate discussions around science projects can help students share their diverse perspectives, thereby driving technological innovation through shared cultural insights [69].

Research suggests that implementing CRT in the classroom can lead to innovative educational outcomes. [70] document the positive impact of the Culturally Responsive Instruction Observation Protocol (CRIOP) on student achievement. Their findings suggest that when teachers incorporate students cultural backgrounds into science projects, students not only engage more deeply but also develop innovative solutions that reflect their heritage. For example, a project where students design experiments based on their cultural practices can foster both innovation and critical thinking skills. Additionally, [71] illustrate how integrating CRT into computational thinking curricula can enhance teacher self-efficacy and student engagement. Their pilot studies show that teachers trained in CRT principles successfully implemented culturally relevant projects, such as robotics programs that resonate with students cultural interests. This approach not only promotes technological innovation but also encourages students to perceive themselves as capable contributors to the field. Another significant initiative involves the use of culturally relevant examples in STEM lessons, where teachers trained in Culturally Responsive Instruction (CRI) techniques reported significant improvements in student engagement and performance [72]. Such pilot studies underscore the effectiveness of CRT in creating inclusive learning environments that drive technological innovation.

[73] suggest that engagement analytics could be designed to reflect the diverse cultural backgrounds of students, potentially enhancing the effectiveness of educational technologies in promoting engagement. Further research could investigate how such analytics can be tailored to support CRT principles, thereby fostering inclusivity in technology-enhanced learning environments. Based on this, the concept of CRT plays an important role in the scope of technopreneurship so that future research recommendations can be made for the development of CRT-based learning models that can improve students mastery of science concepts through problems in a cultural context as well as building students entrepreneurial skills in the scope of technopreneurship.

4. MANAGERIAL IMPLICATION

The integration of CRT in science education offers a strategic pathway to address diverse student needs while simultaneously fostering innovation and entrepreneurship. Managers and policymakers in educational institutions should prioritize professional development programs that equip teachers with CRT competencies, enabling them to create inclusive and culturally relevant learning environments. By aligning educational practices with students cultural contexts, institutions can improve engagement and academic performance, particularly in underserved communities. Moreover, linking CRT with technopreneurship prepares students for the demands of a technology-driven economy, nurturing skills for innovation and problem-solving. Educational leaders should also invest in curriculum designs that incorporate local cultural contexts into STEM education, emphasizing project-based learning to address real-world challenges. This approach not only enhances students mastery of scientific concepts but also builds entrepreneurial capabilities, fostering a new generation of technopreneurs. Such strategic initiatives can position educational institutions as leaders in producing globally competent and culturally aware graduates.

5. CONCLUSION

Based on bibliometric analysis, there are still gaps between variables that have not been connected such as research on teacher storytelling has not directly involved other variables such as college teaching. Then research on teacher professional learning has not directly involved other variables such as preservice teaching. The results of research on the concept of CRT in science education found that there is a relationship between CRT and science materials. Students can more easily understand the concept of science materials through CRT. CRT in science education is a form of teaching that explores and constructs scientific knowledge from students basic knowledge, experience, culture, and environment through scientific methods without ignoring students characteristics and backgrounds. The implementation of CRT in the classroom requires a strong commitment, skills, teacher attitudes and knowledge in creating learning that can accommodate students learning needs based on students diverse characteristics, backgrounds, and cultures. The concept of CRT in science education can encourage students to develop technological innovations that are relevant to the scope of technopreneurship.

To address the identified gaps, future research should focus on exploring how CRT principles can be systematically integrated into teacher professional learning programs and preservice teaching curricula. For instance, studies could investigate how storytelling techniques aligned with CRT principles can be applied in higher education contexts to enhance teaching effectiveness. Furthermore, research should examine the development and implementation of CRT-based teaching models specifically tailored for science education to bridge the gap between theoretical frameworks and classroom practices. Another area for future exploration is the role of the role of Information and Communication Technology (ICT). Education goal has expanded beyond achieving scientific competence; it now aims to produce. Such tools could provide valuable insights into how CRT principles can be operationalized in technology-enhanced learning environments. Additionally, pilot studies focusing on CRT-driven projects in STEM education, such as culturally relevant robotics or computational thinking curricula, could offer practical guidelines for educators and highlight the scalability of CRT in fostering innovation and technopreneurship.

While this study provides a robust bibliometric analysis, it is important to acknowledge its limitations. The analysis relies heavily on existing literature and lacks qualitative insights such as interviews or teacher surveys that could deepen the understanding of the relationship between CRT and technopreneurship. Future research could incorporate such qualitative approaches to complement the bibliometric findings and provide a more holistic perspective on how CRT can be practically implemented to drive technological innovation in classrooms. By addressing these limitations, future studies can better bridge the gap between theoretical insights and practical applications. By prioritizing these research directions, scholars can contribute to a more comprehensive understanding of how CRT can be effectively implemented in diverse educational contexts, ultimately enriching science education and empowering students to engage in meaningful technological innovation.

6. DECLARATIONS

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6.2. Author Contributions

Conceptualization: YI; Methodology: FF; Software: SD; Validation: AA and FA; Formal Analysis: MA and GM; Investigation: YI; Resources: FF; Data Curation: SD; Writing Original Draft Preparation: AA and FA; Writing Review and Editing: MA and GM; Visualization: YI; All authors, YI, FF, SD, AA, and FA, MA, GM have read and agreed to the published version of the manuscript.

6.3. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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The authors received no financial support for the research, authorship, and/or publication of this article.

6.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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