Article

Using Science Mapping to Review Research on Culturally Responsive Teaching in Early Childhood Education

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Abstract: This research aimed to review culturally responsive teaching in early childhood education based on systematic science mapping. We analysed the number of papers published, the number of journal citations, the area in which the paper was published and the paper's keywords. The Scopus database was used to search for keywords, followed by preferred reporting items for systematic reviews and meta-analyses to conduct a systematic literature review. This research also referred to the PRISMA systematic literature review based on article aggregation by using keywords, including "culturally responsive teaching and early childhood education", "culturally responsive teaching for children" and "culturally responsive teaching of preschool". After excluding non-journal articles in the early childhood education, 562 journal articles were obtained in Ris format, which were then uploaded to the VOSviewer software for the bibliometric analysis. Finally, descriptive statistics and the results of the keyword co-occurrence analysis are presented. A total of 562 journal articles were analysed, and the results indicated that: (1) the research topics and the number of publications grew steadily and continuously and could be attributed to two main topic areas: "the impacts of children's family culture" and "the role of the teachers' culture in response to teaching"; (2) the top three journals cited by the papers were: "Teachers College Record", "Teaching and Teacher Education", "Urban Education". The quality of these journals was listed in the first-level core journals or the second-level important journals of the Social Science Citation Index. Besides, the research articles cited were from the first-level core journals, which most of the research articles on cultural response teaching included here were from; (3) the top three geographic areas of the publications were the United States, Australia, New Zealand; (4) keyword co-occurrence analysis revealed five clusters. Among these five clusters, the top five issues focused on teacher training, professional development, urban education, multicultural education, diversity.

1. Introduction

Culturally responsive teaching (CRT) often refers to the ways in which teachers highlight the importance of engaging the learners' cultural contexts, including their schools, families and communities, in the curriculum and instructional planning. Also, it has been found that practices promoting CRT, including differentiated instructions, explicit teaching and peer support strategies, led to students obtaining academic achievements, cultural knowledge and language ability and a stronger ethnic identity, as well as critical thinking skills (Aceves & Orosco, 2014; Aronson, 2020; Hammond, 2015; Piazza, Rao, & Protacio, 2015; Robinson, 2016).

Relevant studies indicated that learners' language, communication style and expression methods were related to their ethnic background, social culture and family environments (Durden, Escalante, & Blitch, 2015). When teachers see these details, they possess the preliminary ability to discern the similarities and differences of cultural contexts among schools, families and communities (Gay, 2018; Ladson-Billings, 2022; Marsico, Dazzani, Ristum, & Bastos, 2015). Clearly, making good use of language and cultural contexts not only increases the mutual trust between students and teachers but also aids in knowledge construction and the accumulation of cultural skills and social interaction (Doran, 2015; Gay, 2013; Linan-Thompson, Lara-Martinez, & Cavazos, 2018; Lucas & Villegas, 2013; Sleeter, 2011; Vygotsky, 1978), which results in great benefits for students' learning (Gunn, 2010; Harvey & Myint, 2014; Milner, 2012; Worthy, Consalvo, Bogard & Russell, 2012) and the promotion of mutual learning between groups of different cultures (Harriott & Martin, 2016).

However, to highlight the spirit of CRT, it is also essential to start with the relationship between the two parties. The dynamics of relationships between teachers and children, as well as between teachers and parents, in ECE, are of significant importance. Only when the connection is rapport, stable and familiar will there be discussions, interactions, acceptance, respect and appreciation

(Anderson, 2015; Berryman, SooHoo, & Nevin, 2013; Wink, 2011). The process of CRT is often subjective to challenges for teachers regarding how much power they are willing to give the learners to learn (Dimick, 2012; Tobisch & Dresel, 2017) and how sufficient the teachers' multicultural literacy, professional knowledge and flexible use of language coping skills are (Herrera, Holmes, & Kavimandan, 2012; Kieran & Anderson, 2019; Ladson-Billings, 1995; Lim, Tan, & Saito, 2019; Rao & Meo, 2016). Across different countries, teachers are encouraged to engage in curriculum design and teaching arrangements with the belief that culture responds to teaching (Ford, 2012; Perry & Southwell, 2011).

Overall, CRT does not impose a set of fixed practices or scripts. Instead, it is adjusted flexibly in response to the learner's classroom structure and cultural background (Gunn & King, 2015; Ladson-Billings, 2022). In applying this concept to teaching, teachers need to consider the scaffolding strategy between school and family culture, the modification of the differences in the teaching-related beliefs of teachers and ways to guide learners to enhance their cultural awareness and skills (Banks, 2016; Iwai, 2019; Mayfield & Garrison-Wade, 2015; Peterson, Gunn, Brice, & Alley, 2015) to achieve the goal of maintaining high academic achievement and performance through culture (Alderman, 2015; Gay, 2002; Gunn, Brice, & Peterson, 2014; Ladson-Billings, 1995).

This research aims to identify key topics related to CRT in ECE, explore ways to improve preschool teachers' CRT skills, and examine the relationship between co-citation analysis and CRT in early childhood education (ECE).

2. Research Methods

CRT is a way for teachers to understand and practice their beliefs in multicultural education. Although the importance of CRT in ECE has been recognised, there remains a lack of a systematic study of this topic to reflect an overview of the related research trends. In this research, the systematic science mapping method was used to review research on preschool education and CRT and to analyse the number of related articles published, the number of journal citations, the geographic areas where the articles were published and the articles' keywords. The contribution of this research to multiethnic cultural education is threefold: (1) to clarify the research context of CRT in the academic community; (2) to assist on-site teachers in their instructional design work and teaching plan design; (3) to serve as more advanced references for related topics.

With the assistance of the bibliometric tool, this study applied the systematic science mapping in-depth to be more accurate in reviewing and analysing large amounts of literature in the database (Moral-Munoz, Lopez-Herrera, Herrera-Viedma, & Cobo, 2019; Thijs, 2019; Van Eck & Waltman, 2017). The systematic science mapping method is suitable for any research involving the identification and data analysis of large amounts of literature (Chen, 2017; Li, Goerlandt, & Reniers, 2021; Santana & Cobo, 2020). There are many database platforms available for searching academic literature internationally (Harzing, 2019; Martin-Martin, Orduna-Malea, Thelwall, & Delgado, 2018). The rationale for choosing the Scopus database for the literature search for this study was that this database contains more comprehensive and complete related literature compared to other databases (Boudry, Baudouin, & Mouriaux, 2018; Wang, Bowers, & Fikis, 2017) and the bibliometric values of the research data presented tended to be more accurate and consistent with the current status (AlRyalat, Malkawi, & Momani, 2019; Gumus, Bellibas, Esen, & Gumus, 2018).

In addition, to increase the rigor of the process of searching for appropriate journal articles, this study also referred to the PRISMA systematic literature review (Page et al., 2021) based on article aggregation by using keywords, including "culturally responsive teaching and early childhood education", "culturally responsive teaching for children" and "culturally responsive teaching of preschool". After excluding non-journal articles in ECE, 562 journal articles were obtained in Ris format, which were then uploaded to the VOSviewer software for the bibliometric analysis. Finally, descriptive statistics and the results of the keyword co-occurrence analysis are presented.

3. Results

Through the systematic science mapping analysis, this study found that the research topics and the number of publications in the field of CRT in ECE have been growing steadily over the past decade. In addition, the scientific literature in this field can be divided into two main categories: "the influences of children's family culture" and "the role of teachers in culturally responsive teaching". These results were consistent with the concepts and principles of CRT as outlined by Gay (2018), Landson-Billings (1995), Villegas and Lucas (2007). Regarding the growth trend over time, the top ten journals cited in the research articles, the top ten publishing regions and the results of the keyword co-occurrence analysis were as follows.

3.1. Growth trend of CRT research in ECE

After searching and compiling the relevant literature in the Scopus database, this research found that the first article about CRT was published in the Language, Culture, and Curriculum Journal in 1994 by Gregory, entitled "Cultural assumptions and early years' pedagogy: The effect of the home culture on minority children's interpretation of reading in school". This study focused on

contrasting interpretations of reading between young children of Bangladeshi origin and their teachers, as well as the implications of these differences for both teaching and learning.

However, research on CRT did not receive much attention during that time. In fact, between 1994 and 2004, there were only four related studies and most of those were focused on clarifying teachers' personal beliefs regarding CRT. Until 2005, this phenomenon shifted gradually to discussions of the relationship and influences of CRT on curriculum designs, family communities, culture and ethnic groups. An example was Lin's (2005) study entitled. "Multicultural visions in early reading classrooms: Implications for early childhood teacher educators", which was one of three studies published in the Journal of Early Childhood Teacher Education on cultural response teaching in 2005 (Cobb, 2005; Jaruszewicz, 2005; Lin, 2005).

In other words, the research on CRT in ECE has drawn greater attention from the academic community since 2005. In the beginning, the research topics were related to the personal cultural competence of teachers before they began to show a more in-depth understanding of the relationships and influences of factors other than teachers.

As to the growth trend of CRT in early childhood, when sorted by age, there were six articles published between 1990 and 1999, 48 articles published between 2000 and 2009, 337 articles published between 2010 and 2019 and 157 articles published between 2020 and the present. It seemed that the number of research studies on CRT in early childhood had not yet developed a systematic context before 2010 because the number of publications was limited when calculated by each single-year or accumulated years.

It was worth noting that the number of publications reached 13 in 2008, a breakthrough number in terms of research on CRT in early childhood, surpassing the threshold of ten articles for the first time. However, these 13 articles were all published in different journals and the number of publications was unstable between 2008 and 2010. It dropped back to seven articles in 2009, and showed a stable increase after 2010. There was an increase by more than 15 publications every year since then. Overall, this study analysed 562 journal articles, 98.9% published after 2000, and 90.4% published after 2010. However, the articles published after 2015 accounted for more than half of the total, and the proportion was as high as 69.4%, as shown in Figure 1.
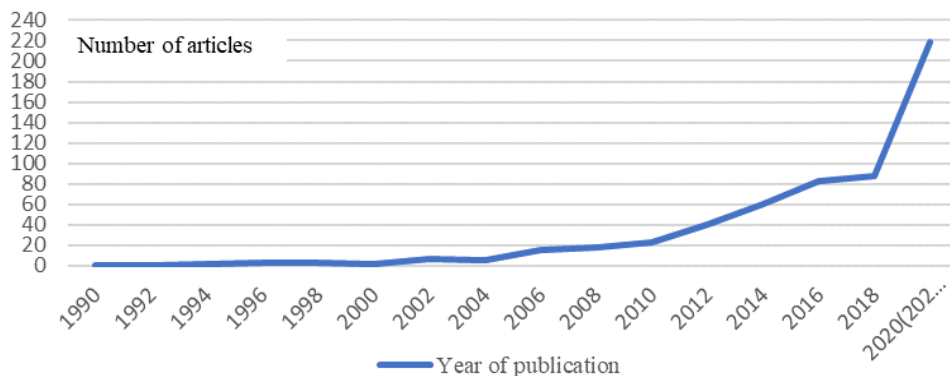
Fig. 1. The growth trend of CRT research in ECE based on the Scopus database.

3.2. Top ten journals cited in CRT research in ECE

After searching for and compiling articles from the Scopus database, we found that since 1994, most of the research on CRT in ECE has been published in the journals dedicated to teacher training, teacher teaching, ECE and multicultural education. These journals aided academics in shaping the academic community and its attributes, and they also provide the directions for CRT research that have guided field teachers to focus on the critical points, thereby providing a great benefit in practice. Furthermore, the results indicated that the top three journals cited by the research articles were Teachers College Record (TCR), Teaching and Teacher Education (TTE) and Urban Education (UE). However, in addition to these three most-cited journals, there were seven other journals also worthy of attention, namely the Journal of Early Childhood Teacher Education (JECTE), Early Childhood Education Journal (ECEJ), Contemporary Issues in Early Childhood (CIEC), Journal of Research in Childhood Education (JRCE), Urban Review (UR), Journal of Early Childhood Literacy (JECL) and Early Child Development and Care (ECDC), as shown in Figure 2.
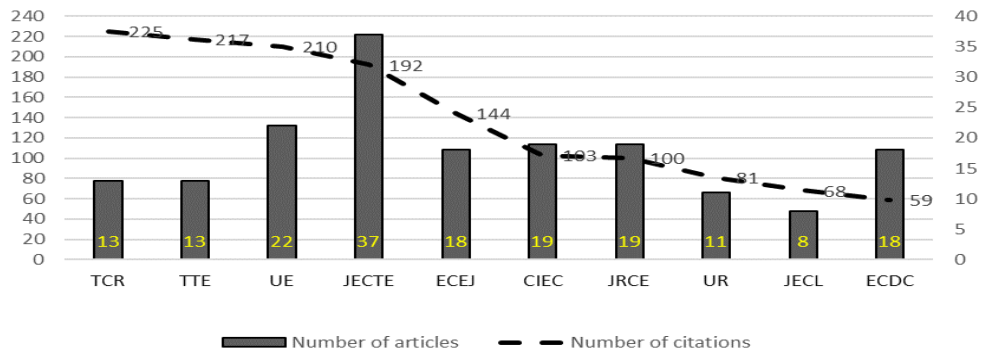
Fig. 2. The number of citations of major journals and articles for CRT research in ECE.

Following the above context, this study conducted an analysis of these top ten journals and found that they were not quite consistent in terms of the influences, ranking status and number of publications of the journals and the number of citations. Although some journals had published more articles, the number of research citations was relatively low, as was the case with Early Child Development and Care. A lower number of citations might imply a lower influence on related research. The top three journals with the most cited research articles were Teachers College Record, Teaching and Teacher Education and Urban Education. These journals were closely related to teachers and teaching and were also included in the list of education research journals by the Social Science Citation Index (SSCI) as the first-level core journals in the field (Q1).

These ten journals were ranked by the number of citations as follows: Teachers College Record (TCR) (225 times), Teaching and Teacher Education (TTE) (217 times), Urban Education (UE) (210 times), Journal of Early Childhood Teacher Education (JECTE) (192 times), Early Childhood Education Journal (ECEJ) (144 times), Contemporary Issues in Early Childhood (CIEC) (103 times), Journal of Research in Childhood Education (JRCE) (100 times), Urban Review (UR) (81 times), Journal of Early Childhood Literacy (JECL) (68 times) and Early Child Development and Care (ECDC) (59 times).

3.3. Publication regions of CRT research in ECE

After searching and compiling the literature from the Scopus database, among a total of 562 journal articles analysed, the top ten countries in terms of the number of publications of CRT research in ECE were the United States (418), Australia (44), New Zealand. (27 articles), Canada (14 articles), the United Kingdom (14 articles), Hong Kong (8 articles), Taiwan (7 articles), Singapore (6 articles), South Korea (6 articles) and Spain (6 articles).

The number of journal articles published and the number of citations by regions are shown in Figure 3. The majority of scholars (74.4%) were from the United States, published either individually or jointly, and their citation numbers in other research articles were also the highest (4759 times), followed by Australia (241 times), the United Kingdom (194 times) and Canada (170 times). Notably, the research regions were not limited to European and American countries but also included Asian countries. For example, journal articles produced in Hong Kong were cited 8 times, articles from Taiwan were cited 37 times, articles from Singapore were cited 14 times and articles from South Korea were cited 76 times.
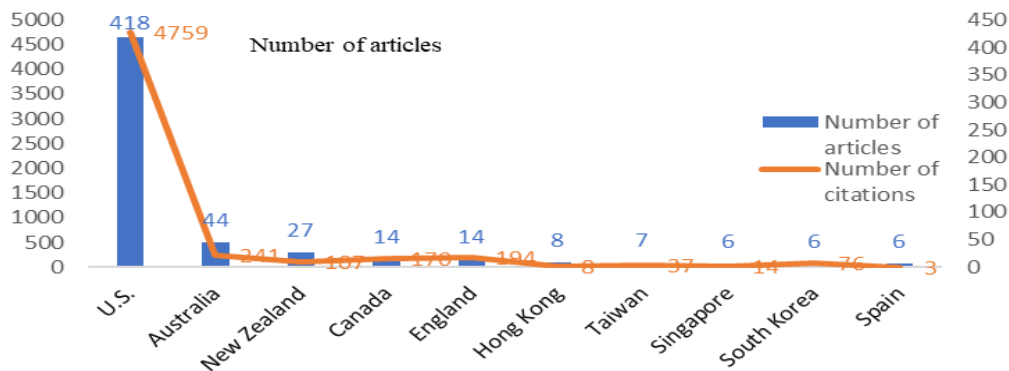
Fig. 3. The number of CRT research in ECE journal articles published and the number of citations by regions

3.4. Keyword co-occurrence analysis of CRT research in ECE

This study used the Scopus database to search and summarise all of the keywords used for CRT research in ECE. A total of 1,376 keywords were used as the analysis targets. The VOSviewer software was utilised for the statistical analyses. The top 20 keywords with the most frequent co-occurrences are listed in Table 1. The first five keywords were "early childhood education", "early children", "teacher education", "culturally relevant pedagogy" and "professional development". Furthermore, "culturally responsive pedagogy" and "early childhood education" were the highly associated research topics in the CRT field. However, "teacher education" and "professional development" highlight the characteristics of CRT research because not only teachers need more professional knowledge, skills and strategies related to cultural competencies but pre-service teacher trainings are equally important to prepare student teachers for their professional roles and to ensure that they are familiar with the basic concepts and skills before they enter their teaching sites (Dengerink, Lunenberg, & Kools, 2015; Rychly & Graves, 2012; Sleeter & Cornbleth, 2011; Timperley, 2013; Zenkov, Pellegrino, Harmon, Ewaida, Bell, Lynch, & Sell, 2013).

Table 1. The number of keyword co-occurrences in CRT research in ECE

Rank Order	Keywords	Number of Co-occurrences
1	early childhood education	70
2	early children	54
3	teacher education	46
4	culturally relevant pedagogy	40
5	professional development	31
6	culturally responsive teaching	30
7	urban education	24
8	multicultural education	23
9	diversity	22
10	race	19
11	culturally responsive pedagogy	17
12	childhood	16
13	early adolescence	16
14	preservice teachers	16
15	pedagogy	16
16	early childhood	15
17	literacy	15
18	cultural diversity	14
19	instructional strategies	13
20	methods and materials	12

Next, to clarify the relationships among keywords of CRT research in ECE, the number of co-occurrences was set to at least five and the relationships among these keywords were analysed. A total of 67 keywords were included in the structure analyses to explore the co-occurrence relationships between the keywords and the research theme.

The results showed that there were five major clusters among the 67 keywords, as depicted in Figure 4. The first cluster with 18 keywords included "assessment", "Black boys", "case study", "cultural responsiveness", "curriculum, bicultural learner", "early childhood education and care", "education", "equity", "basic knowledge", "intervention", "literacy", "multiculturalism", "parents", "pedagogy", "kindergarten", "racism" "teachers". The second cluster with 18 keywords included "early childhood", "childhood", "early adolescence", "adolescence", "college students", "action research", "English learners", "teaching strategies", "language learners", "teaching materials and methods", "multicultural literature", "policies", "professional development", "qualitative research", "socio-cultural theoretical perspectives" and writing". The third cluster with 13 keywords included "early childhood literature", "cultural diversity", "diversity", "tolerance", "inclusive education", "multicultural Education", and "pre-service teachers". The fourth cluster with 9 keywords included "bicultural education", "bilingualism", "cultural and language diversity", "cultural competence", "culture", "early childhood literacy", "enlightenment plan", "mathematics" and "play". The fifth cluster with 9 keywords included "African American students", "cultural reaction", "identity, language", "ethnicity", "society", "theme", "urban" and "urban education".

Further, the relationships among these five clusters of keywords were mainly based on the third cluster, surrounding teacher training, multicultural education and pre-service teachers as the core focus. Then, it extended outward and linked the first cluster of pedagogy, literacy and assessment and the fifth cluster of urban education, race and identity. These three clusters were the most intertwined. The third cluster was also related to the second cluster of professional development, early childhood, childhood, and adolescence and the fourth cluster of bilingualism and cultural ability. But there was no correlation between the second and fifth clusters.

Among them, qualitative research, case studies were commonly used methods for CRT research in ECE, while teacher training, professional development, urban education, multicultural education, diversity, race, childhood, pre-adolescents, pre-employment teachers and pedagogy were the top ten most discussed research topics. Finally, a further examination of time trends in the context of CRT research in ECE indicated that keywords, such as multicultural education, diversity, culture, English learners, teacher views, policies, etc., appeared earlier, followed by teacher training, preservice teachers, pedagogy, urban education, professional development, assessment, cultural competence, play, early childhood literacy, etc. Furthermore, recent journal issues have focused more on topics like teaching strategies, teaching materials, methods, childhood, early adolescence, college students, identity, society, children's literature, etc.

Fig. 4. The network diagram of the keyword co-occurrence analysis for CRT research in ECE

4. Discussions

This study adopted a systematic science mapping method to review the literature on CRT research in ECE. The findings, firstly, indicated that relevant research topics have been paid attention to since 2005. Still, the more significant steady growth occurred after 2010. In the beginning, the research topics were more focused on the personal cultural competence of teachers and then gained a more in-depth understanding of the relationships and influences of factors other than the teachers, such as curriculum designs, families and communities, culture and ethnic groups. Further, this study found that the research topics of CRT may shift from time to time; specifically, from the individual competence of teachers to curriculum design, the culture of families and communities, etc. Such processes proved that CRT is not only related to individual teachers and the school curriculum, but that it is also related to learners' family and community cultures, and how educators understand their own and others' cultural knowledge is quite important as well (Curry, 2016; Rivera-McCutchen, 2012; Sensoy & DiAngelo, 2017). When preschool teachers have CRT competence, it can effectively reduce bias and discrimination against learners (Mellom, Straubhaar, Balderas, Ariail, & Portes, 2018; Zygmunt, Cipollone, Tancock, Clausen, Clark, & Mucherah, 2018).

Secondly, we found that some journals with fewer articles published had more citations. It seemed not necessary that the impact levels of journals as reflected by their number of citations were consistent with the number of articles that the journals have published. Notably, the geographic regions of the publications were not limited to European and American countries. Although the number of research articles published in Asian countries, such as Taiwan and South Korea, were not numerous, the number of their citations reveals an important reference value.

Finally, although the findings indicated that the CRT research themes have changed in different times and spaces, those that remained unchanged were those that used qualitative research, action research and case studies as the primary research methods. The research focus of the academic community was still centered on themes such as teacher training, professional development, urban education, multicultural education, diversity, race, childhood, pre-teens, pre-service teachers and pedagogy. Moreover, the keyword co-occurrence analysis highlighted that most CRT research was closely tied to pre-service teacher training and professional

development. These results support past research showing that, as professionals, educators need to receive appropriate preservice training to obtain a certain level of experience, knowledge and concepts for both curriculum design and teaching, and that continuous learning is required to ensure a high teaching quality (Goodwin & Kosnik, 2013; Karagiorgi & Nicolaidou, 2013; Liston, Borko, & Whitcomb, 2008).

In order for teachers to develop professional CRT competency, cultivating their cultural sensitivity could be the first step. Teachers may, for example, pay particular attention to their own prejudices and biases, as well as cultivate their knowledge of other cultures. Especially, teachers can start from observing the cultural context of the learner's family and community, such as understanding their language, knowledge, experiences, values, attitudes, skills, behaviours, interactions, etc. Then, by recognising the learner's culture as a valuable resource, teachers can make good use of their cultural environment and tools to create a learning environment with positive teacher-student relationships (Davies & Halsey, 2019; Khalifa, Gooden, & Davis, 2016; Minkos, Sassu, Gregory, Patwa, Theodore, & Femc-Bagwell, 2017; Oskineegish, 2015; Ragoonaden & Mueller, 2017).

In terms of the trends of pre-service teacher training and professional development, while cognition has been emphasised as the major teacher competency in the past, it has been gradually replaced by emotional care, relationship building and character virtues in recent years (Fink, 2013; Kubanyiova & Crookes, 2016; Moate & Ruohotie-Lyhty, 2014; Munthe & Rogne, 2015; Nilsson, Ejlertsson, Andersson, & Blomqvist, 2015). These views could be supported by the various processes of CRT, in which teachers show their awareness, acceptance, respect and reflection on the learner's cultural background so that finally, teachers and students can come to a state of mutual understanding and interaction without being separated by differences in each other's cultural backgrounds (McKoy, MacLeod, Walter, & Nolker, 2017; Noonan, 2019; Romijn, Slot, & Leseman, 2021).

5. Conclusions and suggestions

5.1. Conclusions

CRT in ECE would be important. This research found that the research topics and the number of publications grew steadily and continuously and could be attributed to two main topic areas: "the impacts of children's family culture" and "the role of the teachers' culture in response to teaching". We could seek to understand CRT in ECE from the top three journals cited by the papers were: "Teachers College Record", "Teaching and Teacher Education", "Urban Education". Besides, the research articles cited were from the first-level core journals, which most of the research articles on cultural response teaching included here were from. The geographic areas of the publications were the United States, Australia, New Zealand. These findings will facilitate the examination of the relationship between CRT in ECE and various geographic regions. Keyword co-occurrence analysis revealed five clusters. Among these five clusters, the top five issues focused on teacher training, professional development, urban education, multicultural education, diversity. This clarifies that the cultivation of teachers' professional abilities related to CRT in ECE should be implemented and embedded in various courses for early childhood teacher training.

5.2. Suggestions

This study used the Scopus database as a platform on which to search for relevant literature. However, there are other academic search engines available, such as Crossref, EBSCO, Google Scholar, Microsoft Academic, ProQuest and Web of Science. Therefore, future research is suggested to use these academic search engines to integrate, summarise and compare literature and to analyse the similarities and differences of the results based on different indexing tools. Secondly, there are two suggestions for teaching practice: (1) For preservice teacher training, multicultural competence, CRT practice and cultural awareness are essential teaching competencies to train. The development of a curriculum for multicultural education at universities is necessary for students to recognise, perceive and understand the characteristics of learners from different cultural contexts; (2) As culturally responsive teachers, early childhood teachers may constantly reflect on their teaching beliefs and the cultural family background of children and then adjust and modify their instructions and teaching activities as appropriate. Preschool teachers may enhance children's comprehension of concepts and experiences by actively promoting parental engagement in classroom activities and conducting home visits. This strategy seeks to be responsive to the needs of both children and families, while simultaneously strengthening the relationship between teachers and parents. In doing so, it fosters mutual familiarity and collaboration, thereby contributing to a more supportive learning environment. Simultaneously, preschool teachers should engage in meaningful dialogues with parents to strengthen communication skills. It is essential for teachers to critically reassess the dynamics of the child-centered approach within their pedagogical practices, particularly with regard to the learning environment, the selection of educational materials, and the design of the curriculum. In addition, opportunities for further engagement and the learning of CRT to facilitate professional development are important. Preschool teachers may consult relevant journal articles, including those referenced in this study, which serve as valuable resources. Furthermore, they are encouraged to engage in workshops and scholarly discussions to continuously

reflect on their pedagogical practices and curriculum development; (3) We can integrate cultural differences across different regions to enrich research on CRT. In preschool classrooms with children from different cultural backgrounds, it is imperative for teachers to first deepen their understanding of the family backgrounds of these children. This can be accomplished by gathering information from multiple sources, including the Internet, parent-teacher conferences, school events, and informal conversations with parents during school hours. A key principle of CRT is that teachers must engage in self-reflection to assess whether child-centered pedagogical beliefs are effectively implemented in their classrooms. It is critical for teachers to recognize that the learning experiences of children from various cultural backgrounds must be acknowledged and integrated into their instructional practices. By doing so, teachers can create a more relevant and enriching educational experience for young learners within the school environment. Furthermore, to advance research on the integration of cultural differences across different regions, it is essential to focus on the interaction processes among children, teachers, and peers. This includes examining both verbal expressions, such as language, accent, and vocabulary, as well as non-verbal expressions, including gestures, behaviors, and attire, or children's family structures and socioeconomic status.

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