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A review of research on the development of inclusive education in children with special educational needs over the past 10 years: a visual analysis based on CiteSpace

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Background: Childhood is a critical developmental stage, especially for children with special educational needs (SEN), as it can profoundly affect their development and future well-being.

Purpose: To assess the state of research on inclusive education for children with SEN over the last 10 years, 1,024 documents from the Web of Science (WoS) core collection were analyzed.

Methods: Using CiteSpace, a comprehensive analysis included an overview of the field, keyword distribution, research foci, and emerging trends.

Results and conclusions: This study identified that research in inclusive education for children with SEN primarily concentrates on education, psychology, and the development of children with SEN. Furthermore, future research must involve education, psychology, sociology, medicine, rehabilitation, public policy and law, neuroscience, and family studies. Primary research questions should address the effectiveness of education and learning outcomes for children with SEN, their social and emotional development, family support and participation in education, educational policy and practice, and professional development and training for inclusive education teachers. We expect that the future development of research on children with SEN will become more multidimensional and comprehensive. The research focus should shift toward comparative studies of the developmental history of special children and their peers. Methodologically, the integration of quantitative and qualitative approaches is essential. From a research perspective, a stronger emphasis should be on cross-national comparative studies. Moreover, interdisciplinary research and collaboration should be increased to enrich the theoretical and knowledge system of inclusive education for special children, thereby providing a more robust evidence base for inclusive practices.

KEYWORDS

inclusive education, special educational needs, visual analytics, knowledge mapping, CiteSpace, web of science

Introduction

We recognize that the early years of a child's life constitute the most critical development period. However, many young children experience less-than-optimal situations and circumstances during their formative years. The United Nations (UN) Convention on the Rights of Persons with Disabilities (CRPD; United Nations General Assembly, 2006) is an important step in the direction of promoting inclusive education. It is advocated as a means to eliminate barriers, improve outcomes, and eradicate discrimination. Therefore, it is particularly necessary to include the specifics and multidimensional strengthening of inclusion in the education of children with SEN in the definition of its development. Previous attempts at providing inclusive education for children with SEN and numerous studies have been researched in different areas related to integrated education for children with SEN from different disciplinary backgrounds. It is now well established from various studies that the factors affecting the development of inclusive education for children with SEN are multi-dimensional and comprehensive. In terms of the different dimensions of development of children with SEN, most of the literature since 2000 has emphasized their cognitive development (e.g., abilities in memory, attention, and language; Baranek, 2002), social skills (focusing on their ability to interact with others; Kasari et al., 2011), emotional development (involving self-esteem and emotion regulation; King et al., 2003), educational needs (including individualized education plans and effective teaching strategies; Nilsen, 2017), family environment (e.g., family support and coping strategies; Kiami and Goodgold, 2017), physical health and rehabilitation (involving motor skills and medical needs; Coates and Vickerman, 2010), behavioral problems (e.g., assessing and managing behaviors such as attention deficit, ADHD, etc.; Jull, 2008), and the cultural and social context (focusing on the role of social biases and support systems; Warnock et al., 2010). Integrated research across different dimensions has profound implications for understanding the needs and developmental characteristics of children with exceptionalities and developing effective interventions and support strategies to promote their holistic development. Regarding the factors affecting the development of inclusive education for children with SEN, studies have highlighted factors that are associated with the family parenting environment, peer groups, socioeconomic status, family resilience, and policy support, specifically, parents' educational philosophy, attitudes, emotional support, and practical involvement (Kasari et al., 1999; Palmer et al., 2001), school curricula, teacher training and resourcing (Denman, 2015; Drake and Reid, 2018), peer group social interactions (Weiss et al., 2003), and the construction of extensive social networks (Murphy, Carbone, and the Council on Children With Disabilities, 2008; King et al., 2003), as well as society's cultural climate, policy systems, and public attitudes (Amado et al., 2013; Bigby, 2012), which influence the developmental processes of children with SEN in different ways. In addition, many published studies have focused on identifying and evaluating the impact of childhood development on the adjustment and integration of children with SEN into society in adulthood. Firstly, in the area of vocational development and employment, Van Der Veen et al. (2010) explored the current status of children with SEN in obtaining and retaining jobs and the challenges faced by them, as well as the effectiveness of vocational training and support services. Living independently is another key area, with research pointing to assessing their daily living skills and the role of community and family support (Myklebust and Ove Båtevik, 2005). According to Garrote et al. (2017), attention should be paid to social skills training for children with SEN, community participation opportunities and support networks, and other influences on the social adjustment of children with SEN. In the area of education and continuous learning, Shutaleva et al. (2023) suggest that the opportunities and challenges of higher education and lifelong learning programs should be explored. Notably, one study suggests that changes in family roles and the impacts of the family in supporting the independent living of children with SEN should be analyzed through the framework of family dynamics (Desforges and Abouchaar, 2003).

This study employs scientometric analysis to visualize and examine the literature on inclusive education of children with SEN from the past decade in the WoS database. By utilizing knowledge mapping, the aim of this article is not to present an exhaustive study but rather an attempt to generate an overview of progress toward the inclusion of children with SEN in the domain of special education, minimize the impact of researchers' subjective experiences, and objectively identify research hotspots in this field. The aim is to improve the understanding of the current status and trends in the development of inclusive education while comprehensively analyzing its research focus and emerging issues.

Methodology and data sources

Methods

Scientific knowledge mapping is a research method that has emerged in recent years in the fields of scientometrics and informetrics and can be used in the form of mapping to reveal trending research topics in related fields. We chose CiteSpace (Chen, 2004) as a literature data analysis tool to explore the impact of special children's inclusive education in the 10 years from 2015 to 2024 through bibliometric methods and scientific knowledge mapping methods. The study used CiteSpace to map the visualization of research on inclusive education for children with SEN and performed a descriptive statistical analysis of the literature collected regarding country of origin, time of publication, institution, etc. Trends in research themes, general trends, and the relevance of research in different areas of inclusive education for children with SEN were revealed in the form of mapping the underlying aim, leading to answers to the following questions: (1) How did the number of publications and citation frequency in the field of inclusive education for children with SEN change from 2015 to 2024? (2) What are the main research directions in the field? (3) What are the key nodes of literature in the field of inclusive education for children with SEN? (4) How have trending research topics changed and evolved?

First, statistics on the number of annual publications and citation frequency of research on the impact of the inclusion of children with SEN over the last 10 years are presented using a bibliometric method, and the changing trend of both kinds of literature over time from 2015 to 2024 is analyzed.

Subsequently, in the scientific knowledge graph analysis, the CiteSpace 6.3.R1 network visualization tool was used to visualize word frequency statistics and co-occurrence networks for two node types:

cited literature (clustering analysis of research directions and key node literature analysis) and keywords (analysis of the evolution of trending research topics). In the presented visualization scheme, node size is used to represent word frequency (both types of nodes represent the number of citations and frequency of occurrence of keywords, respectively).

Besides word frequency, centrality also serves as a crucial indicator for assessing the significance of nodes within the network. In the CiteSpace visualization scheme, this indicator refers strictly to betweenness centrality, quantifying the degree to which a node falls on the shortest path between any network node. In the context of cluster analysis, we examine two key structural indicators of the clustering network: the Q value and the Mean Silhouette. The former indicates the significance of each cluster within the network, while the latter assesses the homogeneity of nodes within the clusters (Chen et al., 2010).

Data sources

In this study, the relevant literature on child development in the WoS Core Collection over the past 10 years was collected and subjected to statistical analysis. The impact of inclusive education for children with SEN between 2015 and 2024 was investigated. The Social Sciences Citation Index (SSCI) and Arts and Humanities Citation Index (A&HCI), two major citation databases within WoS that are internationally recognized and reflect the level of scholarly research, were chosen as search sources.

A comparison of the literature data obtained by various search methods revealed that the optimal search terms were TS = ("special education" and "inclusion" and "inclusive education"). The document type was identified as an article, the time frame was set to 2015–2024, and the language was specified as English. The search was conducted on May 16, 2024.

Non-research articles, such as book reviews and calls for articles, conference abstracts, letters, data papers, books, news items, and articles not related to the topic, were manually deleted. Finally, 1,024 valid articles were retrieved, and each article includes key information such as the author's name, institution, article's keywords, title, abstract, and publication year. The 1,024 pieces of literature were processed using CiteSpace, which revealed no duplicates. The time parameter in CiteSpace was set to 2015–2024 (slice length=1), and the pruning method for subsequent analysis was Pathfinder. The "Export/References" tool in WoS extracted data from 1,024 articles in plain text format, saved as Download_XXX. This data was subsequently imported into CiteSpace and processed using the Data function. Following creating a new project within CiteSpace, a series of tables and graphs were generated to facilitate the analysis of research trends in inclusive education for children with SEN.

Research on inclusive education of children with SEN

Since 2012, the volume of literature on the topic of inclusive education has experienced a year-on-year increase, consistently exceeding 60 articles annually (see Figure 1). During the 2014 to 2020 period, the international research literature has shown a fluctuating upward trend; since 2020, the amount of literature on the topic of inclusive education research has continued to climb, with the number of articles showing a consistent upward trend. The remarkable increase and stabilization of research publications on inclusive education for children with SEN is closely related to the international emphasis on their development. As the state pays attention to inclusive education for children with SEN, relevant ministries are expected to formulate policies that provide protective measures for this population. Consequently, the availability of educational resources and services for children with SEN should be expanded, in line with the need for

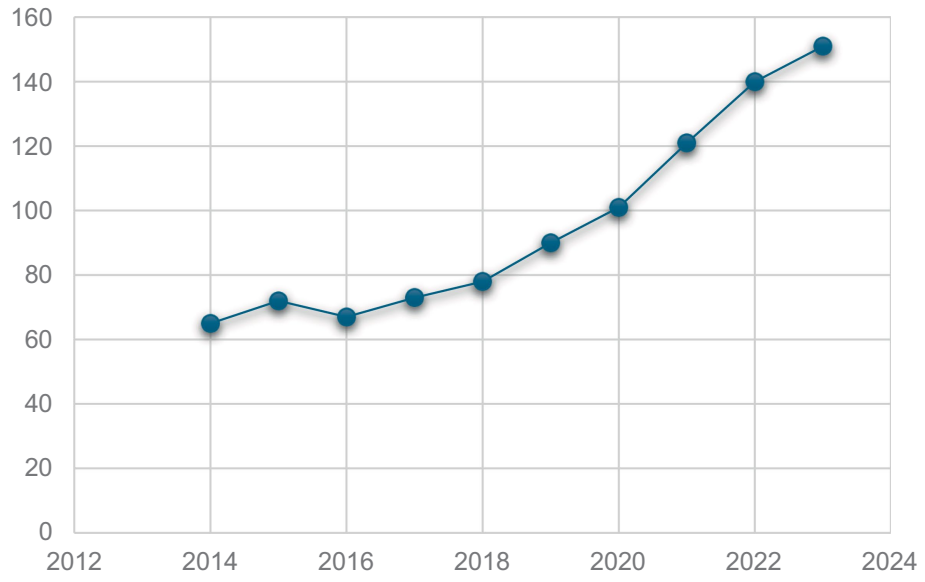

FIGURE 1
Annual publication (2012–2024).

greater awareness in society and support for the holistic development of these children. As a result, there should be a corresponding increase in research efforts in this area.

Table 1 shows that the United States leads significantly in the number of published articles by country, followed by the United Kingdom, Spain, Germany, Australia, Sweden, Canada, South Africa, and others. These nations collectively represent a substantial proportion of global publications in this field. This phenomenon, in addition to being influenced by the relevant policies of international child development and protection, is related to the great importance attached to the development of integrated education for children with SEN by countries around the world, especially developed countries such as the United States and the United Kingdom, in recent decades.

An examination of the institutional distribution presented in Figure 2 indicates that the University of Kansas has emerged as the leading institution in the field of "inclusive education" over the past decade, boasting 34 publications and a centrality measure of 0.07; the institution with a second highest number of publications is North West University—South Africa, with 22 articles and a centrality of 0.02, followed by the University of Vienna, University of Wisconsin System, University of North Carolina, University of London, and other institutions, all with more than 15 articles. Integrating the publication timeline with the analysis reveals that institutional research themes predominantly concentrate on contextual variables, student perceptions, and severe disabilities, as well as Chinese communities, measuring collective efficacy, specific inclusive concern, inclusive classrooms, inclusive preschool, and meaningful change.

TABLE 1 The distribution of countries of publications and their betweenness centrality.

Count	Centrality	Year	Countries
283	0.45	2014	United States
93	0.38	2014	England
79	0.14	2014	Spain
78	0.08	2014	Germany
69	0.31	2014	Australia
50	0.02	2014	Sweden
41	0.07	2014	Canada
41	0.09	2014	South Africa
38	0.08	2014	Norway
37	0.07	2014	Peoples R China
34	0.05	2015	Austria
33	0.02	2014	Finland
31	0.12	2014	Ireland
29	0	2014	Turkey
29	0.01	2018	Saudi Arabia
24	0.06	2015	Italy
24	0.02	2014	Netherlands
18	0.02	2015	Greece
18	0.07	2017	Switzerland
17	0	2014	Israel
15	0.08	2014	Belgium
15	0	2014	Denmark
13	0	2017	France
12	0	2014	Cyprus
11	0	2014	Singapore
10	0.03	2014	Poland
10	0	2014	Scotland

*The data is derived from countries with a publication count of 10 or more.

A co-occurrence map of inclusive education research for children with SEN was generated by dividing the main keywords into time zones. Figure 3 presents more details. In general, the time zone map depicts the different hot topics in inclusive education research for children with SEN during different periods. However, as time progresses, the nodes in the time zone map gradually become smaller. Additionally, the density of hot topics keeps shrinking, and the connection between hotspots is constantly declining.

Four stages of inclusive education research for children with SEN can be identified over the past 10 years: formation (2014), growth (2015–2016), maturity (2017–2020), and decline (2021–2024).

During the formation period, researchers in this field were devoted to exploring the special needs of students with different disabilities and teaching and intervention issues, such as focusing on emotional-behavioral interventions for children with autism and on inclusive education initially involving children with SEN. The research hotspots in the growth period mainly concentrated on the problem of combining theory and practice. Scholars began to introduce early intervention for children with SEN, individual self-efficacy, and the experience of disability and further called for social integration. In the mature period, researchers in the field mainly focused on the challenges encountered by children with SEN and perceptions of disability among different groups (e.g., carers, educators, and people with disabilities themselves, as well as other stakeholders). During the decline period, the popularity of inclusive education research for children with SEN dropped sharply, and no new progress was made, which shows that the research in this field has waned.

Research hot spots and trends

Firstly, keyword analysis was performed in the literature. While the keyword analysis was performed, the node types were selected as Keywords. The period is 1 year; each year, the top 50 keywords with the highest number of citations were analyzed. The resulting network graph of keyword co-occurrence had 253 nodes, 2,104 connecting lines, and density = 0.066, as shown in Figure 4. Keywords with high centrality include inclusive education, students, children, disabilities, special education, attitudes, special educational needs, inclusion, teachers, learning disabilities, instruction, intervention, autism spectrum disorders, learning disabilities, perspectives, behavior, achievement, and self-efficacy.

Figure 5 shows the co-citation cluster mapping of the results of the relevant literature from the WoS database. Several clusters of related literature on inclusive education research can be seen, including young adults, teaching practice, early childhood inclusion, differentiated instruction, and social participation. The seven key clustering areas and their associated keywords were analyzed based on the relevant literature.

FIGURE 2
Bibliometric analysis of research institutions publishing on the inclusive education of children with SEN from 2015 to 2024.

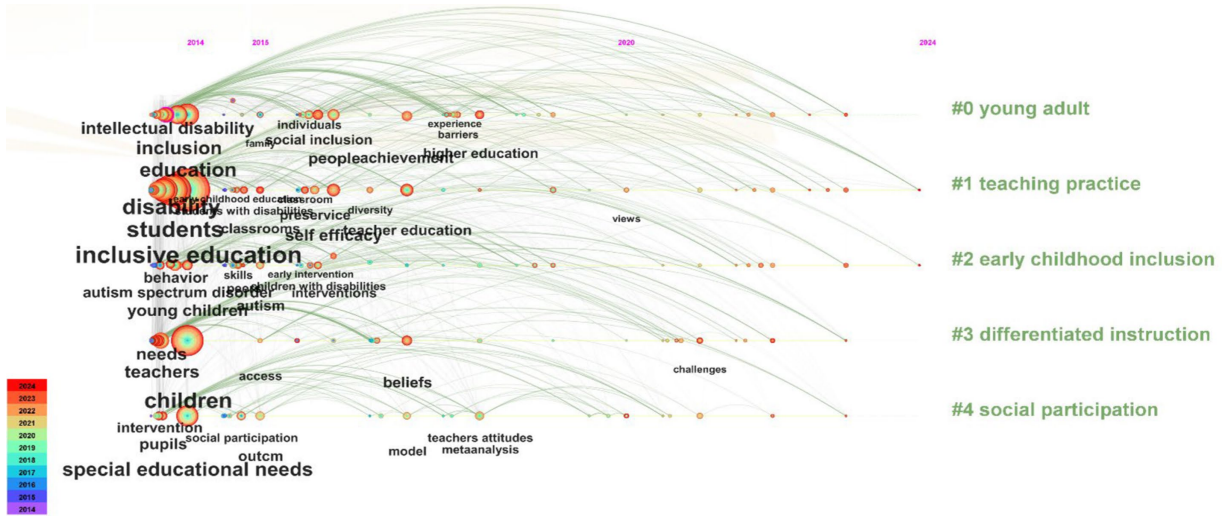

FIGURE 3
Time zone view on inclusive education of children with SEN (2014–2024).

Studies on the impact of educational attitudes and perspectives on inclusive education

Educators' attitudes have a critical impact on the implementation of inclusive education. Norwich (1994) found that positive attitudes toward inclusion are essential for its success, with these attitudes being primarily influenced by child-related factors, such as the nature and severity of the disability (Avramidis and Norwich, 2002). In other words, teachers with inclusive attitudes are more willing to adapt teaching strategies and classroom management styles to meet the needs of children with SEN (Lautenbach and Heyder, 2019). In addition, teachers' perceptions and understanding of disability can directly impact their teaching behaviors and interactions with children with SEN. According to Jordan et al. (1997), teachers with a "pathognomonic" perspective view disabilities as inherent characteristics of the individual, leading to more rigid instructional methods, while those with an "interventionist" perspective see student issues as arising from interactions with their environment and thus adopt more proactive, supportive, and flexible teaching approaches to foster student development. Zagona et al. (2017) further confirmed that when teachers believe disabilities can be mitigated with appropriate educational support, they are more likely to provide positive accommodations for students with SEN. Thus, educators' beliefs about the nature of disability and their responsibilities significantly affect the effectiveness of inclusive education, thereby influencing overall instructional outcomes (Moberg et al., 2019).

Additionally, typical students' attitudes toward children with SEN also affect the effectiveness of special children's access to inclusive education. Positive peer relationships and acceptance contribute to the

FIGURE 4
Network of keywords from publications on inclusive education of children with SEN research (2015–2024).

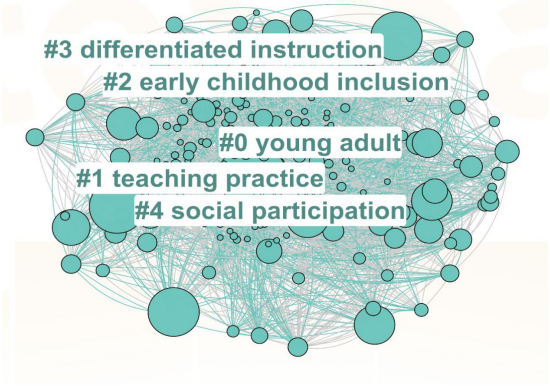

FIGURE 5
Statistics of the literature co-citation network.

development of social skills and emotional support for children with SEN (Freer, 2021), and the support and friendship extended by typically developing peers to children with SEN can enhance the self-esteem and self-confidence of these children, subsequently mitigating their experiences of isolation and anxiety (Taheri et al., 2016).

Parents' attitudes toward a school's program, including implementing inclusive education, are important in promoting inclusion (Paseka and Schwab, 2019). The severity of the disability influences parents' perceptions regarding inclusive education for their children. Research shows that parents of children with mild to moderate disabilities generally support and are satisfied with inclusive educational practices and find them beneficial for academic progress and social integration (Bennett et al., 1997; Orłowski and Wódkiewicz, 1990).

Previous research has highlighted the critical role of principals, in partnership with teaching staff, in promoting an inclusive school environment (Ainscow, 1999; Leo and Barton, 2006). Specifically, school leaders who advocate inclusive education are essential in providing teachers with the necessary training and resources to cultivate a supportive school culture (Cobb, 2014; DeMatthews et al., 2020; Óskarsdóttir et al., 2020; Urton et al., 2014).

Research on the effectiveness of instruction and intervention for children with SEN

Research has shown that individualized teaching approaches and interventions significantly improve children's learning outcomes and self-confidence with SEN (Friend and Cook, 1992). The emphasis on collaborative teaching is grounded in the principle that students are optimally supported in environments that closely resemble those of their non-disabled peers (Vaughn et al., 2023), which stresses the necessity for cooperation between general education and special education teachers (Cook et al., 2017; Friend and Cook, 1992). Moreover, the field of special education is witnessing significant growth in research and applications related to Positive Behavioral Support (PBS), which is an applied science aimed at enhancing individuals' quality of life and mitigating problem behaviors through educational strategies and systemic interventions, emphasizing the development of positive behaviors that foster success and satisfaction across academic, occupational, social, recreational, community, and familial environments (Carr et al., 2002). Additionally, it is well established from a variety of studies that early intervention and social skills training are essential for the early identification of diagnoses and the enhancement of social skills in children with SEN (AAMR

(American Association of Mental Retardation), 2002; Reichow et al., 2014). Research and the implementation of pedagogy focused on multisensory concepts and technological tools in special education are very important because providing multisensory stimulation and using modern technological tools significantly improves the learning outcomes of children with SEN in integrated education (Swanson et al., 2013).

Studies concerning teacher training for inclusive education indicate that effective training encompasses developing teaching skills and integrating theory and practice, thereby enabling educators to tailor their responses to the diverse learning needs of children with SEN (Gidlund, 2018). Another study on interdisciplinary collaboration argues that it is closely related to professional development, where teachers collaborate with special education specialists and social workers to develop support plans to maximize students' learning potential with SEN (Friend and Cook, 1992). According to Karten (2015), teachers obtain feedback from colleagues and experts during their professional development, allowing them to refine their teaching methods through reflective practice and ongoing assessment. This feedback and assessment mechanism helps to continuously improve the quality of teaching and personal competence to better meet the educational needs of children with SEN. In recent years, with the application of the latest research findings and technological advances in the field of special education, for example, virtual environments have exhibited considerable potential within the realm of special education. Initial studies demonstrate that learning in this way transfers to the real-life situation in which the skills are required (Standen et al., 2001). Interactive software fosters active engagement in learning and empowers the user by giving them a sense of control over the learning process (Mora et al., 2017). In addition, evidence-based teaching strategies to support the learning and development of children with SEN have become a significant focus of academic inquiry (Murawski and Swanson, 2001; Pratt et al., 2017). However, professional development involves individual growth and cultivating an entire school culture. Many recent studies (e.g., Gidlund, 2018; Molina Roldán et al., 2021; Wilson et al., 2018) have shown that establishing supportive and inclusive school environments can help children with SEN to integrate better into school life and achieve holistic development.

Studies on the differentiated needs of children with SEN and various types of disabilities

Research on the differentiated needs of children with SEN in inclusive education has centered around their different types of impairments. Odom (2014) suggest that students with intellectual disabilities need the support of an Individualized Education Plan in inclusive education with clear, specific, and achievable learning goals. In addition, the 'small-steps approach' (incremental learning) is widely used in teaching children with exceptionalities, whereby complex tasks are broken down into small, manageable steps and provide repetition and positive feedback (Standen et al., 2001). Furthermore, employing visual support, such as pictures and diagrams, constitutes a vital teaching strategy for differentiated instruction for children with intellectual disabilities (Armstrong et al., 2015). With respect to research on the needs of children with autism spectrum disorders, relevant studies have pointed out that structured teaching, clear routines, and classroom structures are crucial for these students (Mesibov, 2018). Social skills deficits are a prevalent characteristic of children with autism, prompting extensive research focused on enhancing these skills. According to Wolstencroft et al. (2018), social skills training improves social competence through methods such as role-playing and group activities. Regarding research on the behavior management skills of children with autism, Sugai and Horner (2014) suggested that PBS effectively guides and manages the behavior of children with SEN. Additionally, providing sensory-friendly environments and conditioning tools such as noise-canceling headphones and sensory toys are necessary intervention strategies (Case-Smith et al., 2015).

To date, the diverse needs of children with learning disabilities have emerged as a prominent area of focus within the domain of special education. Learning disability is a neurodevelopmental disorder impeding the ability to learn and use academic skills in reading, reading comprehension, spelling, writing, and math (American Psychiatric Association, 2022). However, an earlier study showed that the definition of learning disabilities (LD) emphasizes exclusions: LD cannot primarily result from mental retardation, emotional disturbances, cultural differences, or various disadvantages. Therefore, the concept of LD centers on the notion of a discrepancy between a child's academic performance and their evident capacity to learn (Lyon and Moats, 1997). In the context of research on differentiated teaching strategies for children with learning disabilities, pedagogy based on the multisensory concept helps fully engage the multiple senses of a child with SEN, such as visual, auditory, and tactile senses, in teaching and learning activities (Alenizi, 2019). In addition, technological aids (e.g., reading software and speech recognition technologies), as well as the provision of extra time and specialized support tools (e.g., reading tutoring and writing software), are also key measures to promote effective learning and enhance the outcomes of children with SEN in inclusive education (Edyburn, 2013; Fletcher et al., 2018).

In the field of research on emotional and behavioral disorders, the term 'emotionally disturbed' refers to students whose educational outcomes are adversely affected by a particular type of inappropriate behavior (Wehby et al., 2003). Numerous studies have demonstrated the importance of self-regulation and emotion management skills, as well as the provision of safe and supportive learning environments, in better-controlling emotions and promoting the development of positive behaviors in children with SEN (Gueldner et al., 2020; Sugai and Horner, 2014). In addition, the availability of counseling and emotional support services is essential (Wehby et al., 2003). Regarding research on the differentiated needs of children with sensory and physical impairments, studies have shown that students with visual impairments need Braille textbooks, large print materials, and access to screen reading software and Braille displays (Kizilaslan et al., 2021). Environmental adjustments, including adequate lighting and an optimal classroom layout, are also important (McLinden and McCall, 2016). In addition, orientation and mobility training help students move freely and safely around the campus (Corn and Erin, 2010). With respect to research on the differentiated needs of students with hearing impairments, Mayer and Trezek (2015) reported that students with hearing impairments need to be supported effectively in their access to inclusive education with the help of hearing aids or cochlear implant devices, as well as sign language interpreting services in the classroom. Lip-reading training and incorporating

visual information as a substitute for verbal communication, such as captions and written materials, also play an essential role (Moores, 2014). Data from several studies suggest that many children with autism have sensory and motor difficulties in the early developmental stages (Adrien et al., 1993; Guthrie et al., 2013; Simmons et al., 2009). However, these children have variable performance and significant differences in motor skills (Amato Jr and Slavin, 1998; DeMyer et al., 1972; Rinehart et al., 2001). In the early years of the foundation stage, the acquisition of motor skills is required to learn key competencies such as academic and social skills, and therefore, educational programs or related therapeutic services may need to address motor-related issues (Baranek, 2002). It is important to note that participation in social and physical activities significantly enhances the physical, emotional, and social well-being of children with and without disabilities (Kasari et al., 2011; Murphy et al., 2008), but these children often lack opportunities for participation, resulting in developmental limitations and social isolation (King et al., 2003; Rimmer et al., 2010; Sachsman, 2007). Individuals with developmental disabilities are often excluded from social activities, have limited social networks, and rely primarily on family members and staff (Amado et al., 2013; Bigby, 2012).

Studies on the factors influencing the inclusive education environment

Research on the factors influencing the creation of inclusive education has focused on the physical, community, and social environments. Darling-Hammond et al. (2020) suggest that school buildings and classrooms should have accessibility features, such as ramps, lifts, spacious doorways, and accessible toilets, to ensure the free movement of physically challenged students. Corn and Erin (2010) state that adapted classrooms should be provided in inclusive teaching and learning environments and that classroom arrangements must accommodate the diverse learning needs of students with various special needs, including collaborative learning areas, quiet zones, and zones for sensory manipulation. Related studies have found that different forms of community organizations are likely to exhibit varying attitudes toward individuals with intellectual and developmental disabilities, which can influence the effectiveness of social inclusion efforts (Simplican et al., 2015). As a result, Mitchell (2008) pointed out that community resources and services, such as regular mental health services, vocational training, and extracurricular activities, should be strengthened to provide supportive services and create a positive inclusive community environment for students with SEN. To foster an inclusive social environment, schools should cultivate a culture that values diversity and encourages all students to embrace and support one another's differences (Ronfeldt et al., 2015). Buddy programs and group activities promote interactions and friendships between typical students and students with SEN to help special education students integrate into the group (Wolstencroft et al., 2018).

Moreover, awareness-raising programs within the social environment are crucial in promoting understanding and empathy among students and reducing the stigma faced by students with SEN effectively (Aubé et al., 2021; Scior et al., 2020). For example, organizing workshops themed "Understanding Differences" encourages students to share their experiences, or hosting a "Friendship Day" event where students with and without disabilities participate in activities together to enhance mutual understanding and support.

Studies on the relationship between the inclusive environment and the development and achievement of special students

Inclusive educational environments significantly enhance the academic achievement of students with SEN. Studies indicate that these students access the same high-quality education as their peers and engage with a more comprehensive curriculum in such settings. This exposure fosters their academic growth and promotes their overall performance (Kahu and Nelson, 2018). In addition, teachers in inclusive settings can provide individualized instructional support and assistive technology based on the specific needs of their exceptional learners, such as using pedagogy based on the principles of a multisensory approach and technology-enhanced devices to help them better understand and manage what they are learning (Edyburn, 2013; Smith et al., 2012). Yakut and Akgul (2023) suggested that students with SEN tend to exhibit higher self-esteem and self-efficacy in an inclusive environment. This occurs because they are recognized as integral class members, engage actively in school activities, and receive peer acceptance and support. As a result, this sense of belonging and acceptance enhances their confidence in their own abilities. Moreover, the social interactions and support within the inclusive education environment significantly enhance students' self-efficacy with SEN. Through participation in cooperative learning and group activities, students with SEN can form friendships with their typically developing peers and acquire essential social skills, thereby fostering increased self-confidence and self-efficacy (Wolstencroft et al., 2018).

Studies on the impact of inclusive education on the behavior and social skills of children with SEN

Sugai and Horner (2014) suggested that adopting PBS and a Behavioral Intervention Plan effectively reduced inappropriate behaviors of children with SEN. Furthermore, within an inclusive environment, exceptional children can observe and emulate the positive behavioral patterns of their typically developing peers, thereby establishing and reinforcing beneficial behavioral habits (Ronfeldt et al., 2015). There is a wealth of relevant research addressing the development of social skills in children with SEN. Social skills refer to socially accepted behaviors acquired through learning which help individuals engage with others in ways that promote positive responses and reduce negative responses (Elliott and Gresham, 1993). Developing social skills is among the most significant achievements of the education process. Many children who are not accepted by their peers and have trouble with social interactions are vulnerable to social–emotional issues and poor academic performance (Parker et al., 2015; Wolstencroft et al., 2018). Moreover, relevant studies on the quality of friendships of children with SEN show that integrated environments enable these children

to establish lasting friendships and feel accepted and supported by their peers, which helps not only to improve their social skills but also to enhance their sense of belonging and self-esteem (Simplican et al., 2015).

Moreover, social skills training programs help children with SEN to develop and apply effective social strategies through role-playing, modeling, and practice, thereby improving the quality of social interactions, which further helps them to develop the necessary social skills and increase their self-confidence (Gueldner et al., 2020).

Mutative keywords refer to keywords that have a sudden increase in frequency within a certain period (Sun et al., 2023). Burst detection allows for the identification of evolving trends in research on inclusive education in the field of special education. This method enables the review and prediction of key issues that are likely to become prominent or have a continuous bursting trend in the future (Shen et al., 2022). Figure 6 shows the emergent keywords of research on integrated education for children with SEN, from which three characteristics can be summarized. First, an analysis of the keywords reveals that the highest centrality is social inclusion, followed by mental retardation, social skills, and programs, each exhibiting a centrality score of 3.5 or higher. Over the past decade, the research focus on inclusive education for children with SEN has shifted. In the early period (2014–2017), scholars primarily concentrated on issues such as intellectual disability, social skills, education policy, preparing teachers, sentiments, and general curriculum. However, in the middle to the late period (2018–2024), the emphasis transitioned toward meta-analysis, experiences, participation, challenges, social integration, physical education, interventions, teacher training, etc., to provide educational resources and support services.

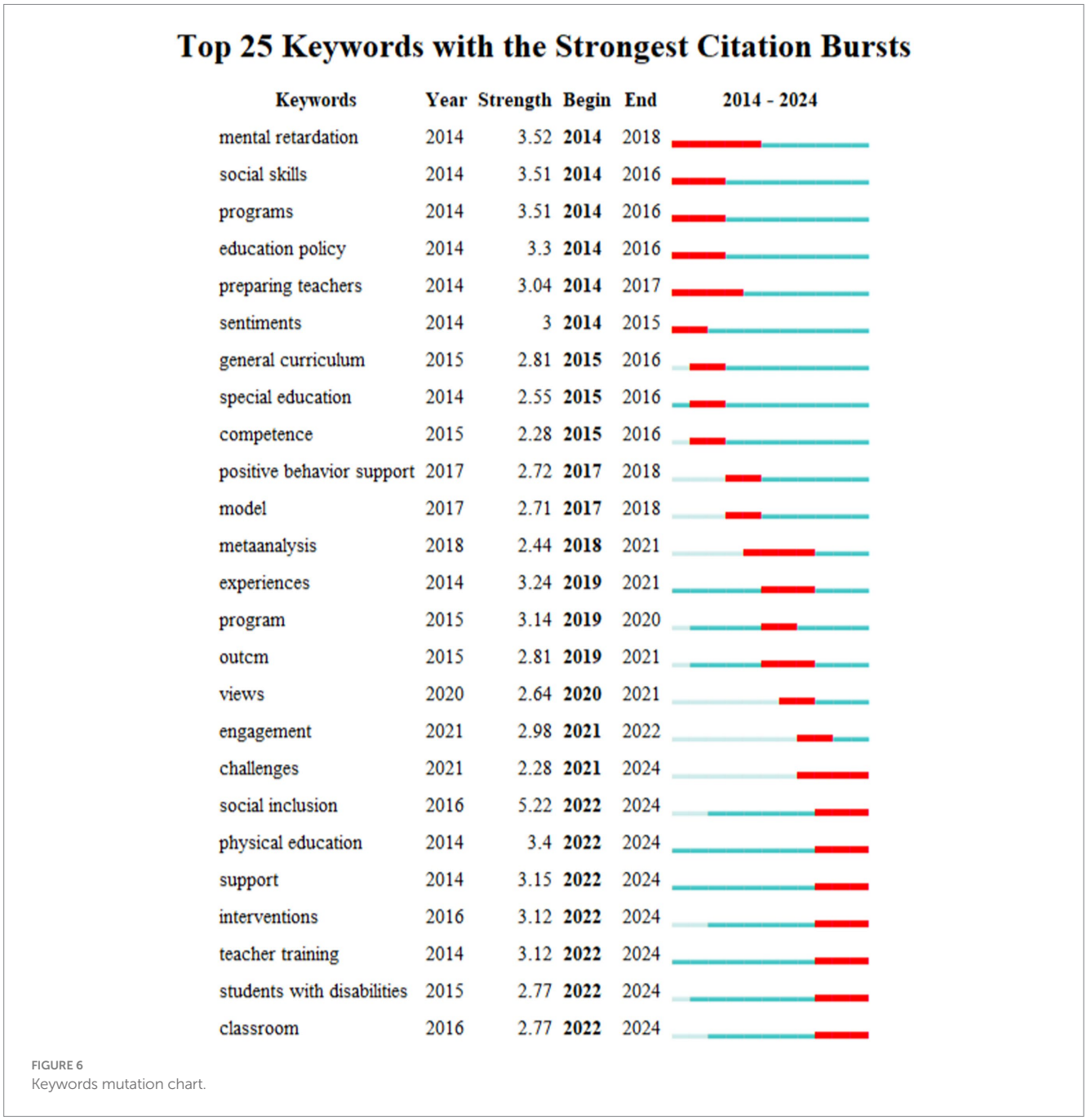

FIGURE 6
Keywords mutation chart.

Third, all the keywords have a relatively short period of mutation, which also indicates that most of the keywords are prone to be replaced by new words over time, but in comparison, the keywords that have a slightly longer time of mutation are mental retardation, preparing teachers, meta-analysis, and challenges, which last for about 3 years.

Discussion

This study applied visual mapping to analyze the current literature on the progression of inclusive education for children with SEN, highlighting key research areas and trends from the past decade. A familiar statement of the basis of the right for inclusion is the Salamanca Statement (UNESCO, 1994), which is an explicit statement concerning children's rights that refers to education and level of learning rather than a mechanism (inclusion). Since then, the development and research of inclusive education for children with SEN has become a hot topic in the academic world, but the focus of research on the development of inclusive education for children with SEN varies in each country as a result of the differences between countries and circumstances of the researchers, as well as differences in the policy system. This study addressed the following topics in the discussion.

Firstly, research on the development of inclusive education for children with SEN has become increasingly comprehensive, addressing not only teaching methods and interventions for children with SEN, the differentiated needs of children with SEN across different disabilities, the development and achievement of students with SEN, and behavioral and social skills but also attitudes and concepts of education, teacher training, and professional development, as well as the key influencing factors of the inclusion environment.

Secondly, there is a diversified trend in the disciplines of research on the development of inclusive education for children with SEN. In addition to education and psychology, which have traditionally focused on inclusive education for these children, interdisciplinary fields such as medicine and sociology have also produced extensive literature on this topic. Numerous disciplines have explored the development of inclusive education for children with SEN from various perspectives and at multiple levels. Neuropsychology has recently become an important concept that supports the notion of inclusive education. It is a tool for understanding and addressing the specific needs of pupils with different neurodevelopmental, cognitive, and emotional disorders in certain areas. The refined diagnosis of specific learning disabilities such as dyslexia, dyscalculia, ADHD, autism, and others has implications for the development of Individual Education Plans (IEPs) that reflect the unique needs of each student, particularly in the areas of students' cognitive skills such as memory, attention, executive functioning, and others.

Thirdly, in exploring the development of inclusive education for children with SEN, it is common to differentiate between children with different disabilities because of the greater heterogeneity among children with different types of disabilities in the field of special education (see, for example, Norwich, 1996). Parents of children with severe disabilities tend to support inclusive education, perceiving benefits such as enhanced social integration (De Boer et al., 2010; Downing and Peckham-Hardin, 2007; Hanline and Halvorsen, 1989). Nevertheless, they express concerns about safety, peer attitudes, and the quality of educational services (Hanline and Halvorsen, 1989; Palmer et al., 2001). It should be noted that apart from the topic of the development of inclusive education for children with autism spectrum disorder (ASD), the body of literature addressing the career and social adjustment of students with ASD in adulthood, cross-cultural comparative studies, long-term mental health and emotional development, and the effectiveness of technology and assistive devices is markedly limited.

Fourthly, regarding selecting topics for research on inclusive education for children with SEN, prior research often began its exploration with narrow and specific topics related to the development of these children. Notably, studies within the realm of psychology have predominantly employed quantitative methodologies, utilizing more precise and in-depth focal points. This approach has yielded findings that are notably more targeted and relevant.

Limitations and future research

Research on issues related to the development of integrated education for children with SEN has already formed a relatively advanced research system, including the understanding and analyzing relevant concepts, measurement and operationalization, identification of influencing mechanisms, intervention mechanisms and policies, etc. In future research endeavors, the following aspects can be explored.

(1) The research on the development of children with SEN is multidimensional and heterogeneous. Alongside supplementary education for children with deafblindness and emotional and behavioral interventions for children with SEN, the assessment and monitoring of mental health, self-determination, and resilience in this population represent a critical area of focus. Consequently, advancing the research framework concerning children with SEN is essential. This advancement should include a comprehensive exploration of concepts related to special needs, particularly those associated with psychological development, and an examination of how to effectively synthesize relevant theories with practical implementation strategies.

(2) The study of the development of children with SEN is interdisciplinary and encompasses various fields, including pedagogy, psychology, sociology, social work, social security, public administration, etc. Therefore, it is crucial to incorporate findings from cutting-edge research across various disciplines, rectify the shortcomings associated with fragmented research fields, and promote interdisciplinary collaboration. This approach will enrich the theoretical and methodological framework related to the psycho-social development of children with SEN.

(3) In the future, the developmental fields of children with SEN should be classified and researched more scientifically and specifically. For example, scientific measurements and operations should be carried out in specific areas such as the cognitive development, physical development, and psychological development of children with SEN to build a system of indicators of children with SEN with validity and credibility and to expand the depth of research on the development of children with SEN. The topic of inclusive education currently makes little use of the point of view of one group of prominent participants—the pupils with SEN themselves. The topic calls for a qualitative methodology and the acquisition of feedback information for researchers and educators in practice.

(4) Future efforts should focus on conducting comparative research across different countries. International comparative

research can address similarities and differences in the developmental milestones of children with SEN and typically developing children in different countries or regions, as well as their difficulties and challenges, mechanisms of influence, social policies, and other related topics. International comparative research can facilitate establishing a research dialog, promoting access to quality education and development for children with SEN.

Conclusion

In summary, CiteSpace, as a tool for visual analysis, is effective at illustrating the overall landscape of literature and research related to the development of inclusive education for children with SEN through map representations. This visualization facilitates a clearer understanding of the prevailing hotspots and trends within the entire research domain.

On the other hand, it is essential to recognize that CiteSpace has both analytical capabilities and limitations. Firstly, it mainly relies on the WoS database, and literature and citations not included in this database cannot be analyzed comprehensively, which may lead to a lack of representativeness and comprehensiveness of the results. Considering that the WoS database offers extensive coverage of literature in the natural sciences, engineering, and technology, CiteSpace may have a disciplinary bias when analyzing social sciences and humanities literature. At the same time, the database is updated with a certain time lag, so the latest research results may not be reflected promptly in the analysis results. It should be noted that when the visual mapping and analysis results are being interpreted, the subjective judgment of the researcher will affect the interpretation, which may lead to differences in the interpretation of the same results by different researchers. Thus, future research ought to endeavor to overcome the limitations of current tools by integrating multiple visualization and analysis techniques, thereby augmenting the study and obtaining more persuasive results.

It is important to highlight that, from the perspective of academic journals, there exists a variety of specialized publications dedicated to the development of children with SEN and their rights, such as the Journal of Special Education, Journal of Autism and Developmental Disorders, Exceptional Children, Research in Developmental Disabilities, Disability and Society, Journal of Intellectual Disability Research, etc., which has a significant impact on the field. In future initiatives, it is hoped that these specialized journals could function as platforms for advocacy regarding children with SEN.

Moreover, exploring modern outreach strategies, such as utilizing short video platforms to effectively disseminate knowledge about special education, is crucial. Developing a series of micro-lesson videos focused on inclusion could further enhance public awareness and foster greater acceptance of children with SEN. Additionally, promoting the fulfillment of special children's potential at international events such as the Paralympics and Special Olympics could contribute further to this goal.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

XL: Data curation, Resources, Writing – original draft, Writing – review & editing, Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Validation. MP: Data curation, Resources, Writing – original draft, Writing – review & editing, Supervision.

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While preparing this work, the author used ChatGPT to optimize language and enhance sentence wording in parts of the content. After using this tool, the author reviewed and edited the content as needed and took full responsibility for the content.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that Generative AI was used in the creation of this manuscript. Grammarly was used for editing.

Publisher's note

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