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An international systematic review of the ICF in education: cross-language comparisons from Chinese, German, Italian, and Portuguese publications

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The International Classification of Functioning, Disability, and Health (ICF), established by the World Health Organization (WHO), provides a biopsychosocial framework for understanding and addressing human functioning and disability. This systematic review examines the application of the ICF in educational contexts across four non-English languages: Chinese, German, Italian, and Portuguese. The findings reveal significant cross-cultural and linguistic variations in interpretation and implementation, shaped by each country's socio-political, historical, and educational landscape. By analyzing 54 peer-reviewed publications, this review identifies key practical applications of the ICF in fostering inclusive educational practices. The study highlights how the ICF has influenced a shift from medicalized models of disability toward holistic, participation-centered approaches. Specifically, the ICF is used in Chinese literature to guide activity-based assessments in special education, in German studies as a broad theoretical framework, and in Italian and Portuguese research as a practical tool for inclusive education in mainstream settings. Despite its potential, challenges remain in cross-cultural integration, including inconsistencies in adoption and the need for deeper application beyond theoretical references. To enhance the ICF's impact in education, this review underscores the necessity for training, cross-cultural collaboration, and policy refinement. Strengthening educators' and policymakers' understanding of ICF principles can facilitate its integration into mainstream education, ensuring a more inclusive and supportive learning environment for students with disabilities and those requiring additional support.

KEYWORDS

education, disability, ICF, inclusion, special needs

Introduction

The International Classification of Functioning, Disability, and Health (ICF), developed by the World Health Organization (WHO), and released in 2001, provides a bio-psycho-social classification framework for understanding and describing human functioning and disability. The ICF shifts the focus from a purely medical model of disability to a more holistic approach, which considers the interplay between an individual's health condition, body functions, activities and participation, as well as contextual factors, including environmental and personal influences (Chapireau, 2005; Imms et al., 2017; World Health Organization, 2001). This innovative classification system has been instrumental in promoting a more inclusive understanding of disability, emphasizing the importance of participation and activity in various life areas such as health, community care, social security, employment and education (World Health Organization, 2007).

The WHO extended the ICF framework with the publication of the International Classification of Functioning, Disability, and Health for Children and Youth (ICF-CY) in 2007. This extension was designed to be sensitive to changes linked to development and growth while also addressing the unique educational needs of younger populations, thereby broadening the application of the ICF across the lifespan (Hwang et al., 2014; World Health Organization, 2007). The theoretical underpinnings of the ICF-CY are identical to the original ICF from 2001 as the differences are to be found in the coding framework itself. After a few years of using the two frameworks in tandem, it was decided to integrate the ICF-CY into the broader ICF framework in 2012, marking a significant advancement in harmonizing health and educational assessments and interventions; this now made it possible to apply the ICF across different age groups and settings (World Health Organization, 2012). To clarify terminology, since the ICF-CY is now regarded as a historical document, this paper will primarily reference the ICF; however, the term ICF-CY will be retained if specifically cited in a particular paper included in the current review.

The WHO stated that one of the aims of the ICF is to establish a common language through its systematic coding scheme that would strengthen communication between different stakeholder groups, inter-professional education, and collaborative practice and would permit data comparison across countries (Moran et al., 2020; Paltamaa et al., 2024; World Health Organization, 2001). Hence, it holds great appeal for a study like the current one, which specifically aims to compare data across different non-English language groups and cultures.

Over the past two decades, the ICF has been used worldwide as a conceptual framework with its main areas of application in health care (van der Veen et al., 2022), clinical settings (Paltamaa et al., 2024), social services (Almborg and Welmer, 2011), and education (De Polo et al., 2009; Leonardi et al., 2022). Its non-categorical approach, which does not rely on traditional diagnostic labels, has made it particularly valuable in educational settings, where it supports the development of inclusive practices and the conceptualizing of "special educational needs" (Norwich, 2016; Woolfson, 2024). The ICF can be used to underpin reforms in education, as is seen in Switzerland, where the ICF is used in education to classify children and establish eligibility and to plan and ensure school-based support (Hollenweger, 2011; Hollenweger and Lienhard, 2007). In Italy, the use of the ICF has shown great potential concerning local experiences in education (Besio et al., 2008). There have also been challenges in applying the ICF in education, as witnessed in Portugal between 2008 and 2018 when the ICF-CY was implemented as a framework for determining students' eligibility for special educational support. However, its application was not without questions. A top-down approach to its introduction led to significant resistance from educators, who perceived it as rigid and imposed without sufficient consultation. This resistance stemmed partly from concerns that the framework, despite its intended flexibility, was being used in a way that categorized students rather than supporting a more individualized and holistic approach. As a result, the ICF-CY was sometimes seen as contradicting its original purpose of shifting focus away from diagnostic labels (Sanches-Ferreira et al., 2018). The ICF framework does, however, allow educators and policymakers to focus on the functional abilities of students rather than their limitations, thereby fostering a more supportive and inclusive learning environment (Hadar-Frumer et al., 2023).

Despite its widespread recognition, the application of the ICF in education varies significantly across different countries and cultural contexts. Previous studies, such as the ground-breaking review that set the scene for how the ICF was and could be used in the education field by Moretti et al. (2012), have explored the use of the ICF in education, particularly in English-speaking countries. However, there is a lack of comprehensive research on how the ICF is applied in non-English-speaking regions, where cultural and linguistic factors may influence its implementation and interpretation. It was decided that a more international scope to this present review of the ICF and education was called for with a cross-comparison of languages and cultures.

This study aims to fill this gap by updating and extending the Moretti et al. (2012) study to conduct a systematic review of the use of the ICF in education across four non-English languages: Chinese, German, Italian, and Portuguese. These languages represent a broad selection of global languages and were chosen based on a combination of convenience and representation. While it would have been ideal to include even more languages, the practical considerations associated with undertaking this global study had to be taken into account. Although this study distinguishes between these four languages, we acknowledge that the boundaries between language, national identity, and cultural context may overlap. Therefore, for the purposes of this study, 'German' refers to the language spoken in Germany, Austria, and Switzerland, as well as the broader cultural context shared among these countries. Similarly, 'Portuguese' refers to the language spoken in both Portugal and Brazil, and 'Chinese' to mainland China and Taiwan, with cultural considerations for each region. By examining how the ICF is employed in these diverse linguistic and cultural contexts, this review seeks to uncover cross-language and cultural differences and similarities in the application of the ICF in educational settings. The focus is on understanding how the ICF is used to support children with disabilities, students with Special Educational Needs (SEN), including those who require additional support, while also identifying the challenges and opportunities associated with its implementation. This study follows a recent one conducted by our research group that identified publications related to the African continent using English search strings (Naude et al., 2024). The

question remains as to how the ICF has been used in non-English literature across globally.

The primary aim of this study is to explore how the ICF is employed in educational settings in countries where English is not the primary language. The findings will contribute to the growing body of knowledge on the ICF's role in education, offering insights into its local and global applications as well as its potential for fostering inclusive education.

2 Contextual background and rational

Education systems worldwide are increasingly recognizing the need to create inclusive environments that meet and accommodate the diverse needs of all students, including those with disabilities (Köpfer et al., 2021). The ICF's comprehensive framework, which considers multiple dimensions of health and functioning, offers a valuable tool for achieving this goal. However, the extent to which the ICF is integrated into educational practices varies significantly, influenced by factors such as national policies, cultural attitudes towards disability, and the availability of resources and training.

In contexts like mainland China, Taiwan, Germany, Switzerland, Austria, Italy, Portugal, and Brazil, where this review focuses, the adoption of the ICF in education reflects different historical, cultural, and socio-political contexts. For instance, the educational systems of mainland China and Taiwan have undergone rapid changes in recent years, with increasing attention to inclusive education. In contrast, the approach to disability in Germany-speaking countries has traditionally been more medicalized focusing on diagnosis and treatment. However, recent shifts toward inclusion are evident (Köpfer et al., 2021; Maschke, 2008; Powell, 2010). Italy and Portugal, with their strong emphasis on inclusive education, present unique contexts where the ICF's application may differ from that of other countries.

Given these differences, a cross-cultural comparison of the ICF's use in education is timely and necessary to understand how global frameworks like the ICF can be domesticated in local contexts. This study, therefore, provides a comprehensive examination of how the ICF is employed across different languages and cultures, offering insights into the challenges and successes of implementing the ICF in diverse educational settings. By highlighting the cultural and linguistic nuances in the use of the ICF, this review offers valuable recommendations for educators, policymakers, and researchers about current practices and areas for further exploration in the pursuit of fully inclusive educational systems.

3 Methodology

This study forms part of a larger international review project on the ICF and education. The authors of the original paper (Moretti et al., 2012) contacted a group of researchers with expertise in the ICF, education, and English language proficiency via an email invitation letter to participate in this study. This newly formed international research group convened remotely on a monthly basis to discuss the project stages from 2020 onward.

The participating researchers were based in or had research projects in several countries, including mainland China and Taiwan (Asia), South Africa (Africa), Austria, Italy, Norway, Portugal, and Switzerland (Europe), and Brazil and Mexico (South America). This review process took around four years due to several reasons, including the researchers' locations across various regions and time zones, as well as cultural differences, logistical challenges and the need to align diverse academic practices.

3.1 Research design

Although English is widely regarded as the current lingua franca of science, similar to Latin and Greek in its time (Kamadjeu, 2019) this study chose to specifically focus on the body of non-English literature. A systematic review design was implemented to explore the application of the ICF in educational contexts across non-English-speaking regions, specifically focusing on publications written in Chinese, German, Italian, and Portuguese. Systematic reviews are particularly valuable when seeking to synthesize a large body of literature to understand how a specific framework or concept is utilized across different settings. This review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure a comprehensive and transparent process (Page et al., 2021).

3.2 identifying the research questions

The research questions were formulated in collaboration with an international group of researchers, including the authors of this study, who are familiar with the ICF and its application in education. This approach ensured that the research questions were relevant to a global audience and addressed key issues in the field. The primary research questions guiding this review were:

   i) How is the ICF used in education based on research published in four non-English languages, namely Chinese, German, Italian, and Portuguese?
   ii) What cross-language differences exist in the use of ICF in education?
   iii) What challenges arise when using the ICF in educational contexts across different cultures?

3.3 Identifying relevant studies

3.3.1 Search strategy

To identify relevant studies, a comprehensive search strategy was developed, guided by the Population/Concept/Context (PCC) framework recommended by the Joanna Briggs Institute for scoping and systematic reviews. The search terms included variations and combinations related to the ICF, special educational needs, and the educational context. Given the multilingual nature of this study, the search terms were translated using an analogous translation rather than a literal one, considering the specific local discursive nuances, to ensure a thorough examination of relevant

literature in these languages (Bolduc, 2022). Each of the languages has a structured grammatical system, including rules for sentence construction, verb conjugation, and noun-adjective agreement, though the specifics of these systems vary greatly. Search terms were established in Afrikaans, English, Chinese, German, Italian and Portuguese. However, non-English literature was only analyzed for four languages—Chinese, German, Italian, and Portuguese—since the initial search for Afrikaans did not yield relevant findings.

The literature search process was not conducted simultaneously across all languages due to varying work rates and progress within the group. While the initial search of publications was conducted between October 2020 and February 2021, publications written in Portuguese were expanded at a later date in September 2022, to enhance the breadth of the review. This discrepancy in timing between language groups may have introduced variability in the findings, such as differences in the availability of newly published works in some languages compared to others. Despite this, the staggered approach allowed for a more thorough inclusion of studies, particularly from Portuguese sources.

A comprehensive search was conducted across multiple databases in these four languages, targeting literature published between 2001 and 2022. Given that the ICF was first published in 2001, this year was used as a starting point of the review. The search focused on peer-reviewed journal articles and research reports, while gray literature (e.g., books, book chapters, dissertations, newsletters, policy documents, and discussion threads) was excluded to maintain the scientific rigor.

For all searches, terms referring to the ICF/ICF-CY components and education were combined, using the BOOLEAN operators AND and OR, and relevant abbreviations for special educational needs (e.g. SEN) or combinations of search terms. Discussions among the authors, in consultation with experts and research librarians, refined the search terms to ensure accuracy and adherence to search standards, enhancing the effectiveness of the electronic search (Ramirez et al., 2022; Spencer and Eldredge, 2018). Search terms related to the ICF/ICF-CY and education were included and truncation (*) was included where appropriate. The final search string was determined as follows:

("ICF" OR "International Classification of functioning") AND (school OR inclus* OR SNE OR SEN OR "special needs" OR Special Ed OR SpecEd OR SPED).

This search string was translated into Chinese, German, Italian, and Portuguese using the analogous translation approach discussed earlier and applied to the respective national databases.

3.3.1.1 Chinese

The Airiti Library, NCL Taiwan Periodical Literature, HyRead Journal, CNK, China Science and Technology Journal Database, and Wanfang Database were searched using the following translation of the search string in both Traditional and Simplified Chinese: ("國際健康功能與身心障礙分類系統" OR "國際功能分類系統") AND 教育 AND (學校 OR 融合* OR 特殊需求教育 OR 特殊教育需求 OR "特殊需求" OR 特殊教育 OR 特教 OR 資格 OR 目標 OR 鑑定) ("国际功能残疾和健康分类"OR "国际功能分类") AND 教育 AND (学校 OR 合教育 OR 全纳教育 OR 特殊需求 OR 特殊教育 OR 个别化教育 OR资格 OR目标 OR 识别).

3.3.1.2 German

The databases peDOCS (pedocs.de) and PSYNDEX (psyindex.de) were searched using the following translation of the search string: (ICF OR "international classification of functioning" OR "internationale klassifikation der funktionsfähigkeit") AND (*schul* OR inklusi* OR integrati* OR SPF OR ISF OR pädagog* OR sonderpädagogi* OR heilpädagogi* OR förder* OR lernziel* OR diagnos*)

3.3.1.3 Italian

The databases ERIC, ASSIA, SCOPUS, ESSPER, GRUPPO ABELE, RIVISTEWEB and TORROSSA were searched using the following translation of the search string: ("ICF" OR "Classificazione Internazionale del funzionamento") AND (scuola OR inclus* OR BES OR "bisogni speciali" OR Educ Speciale).

3.3.1.4 Portuguese

The Virtual Health Library (VHL/BVS), Portuguese Open Access Scientific Repositories (RCAAP), Scientific Electronic Library Online (Scielo), Ibero-American Network of Innovation and Scientific Knowledge (REDIB) were searched using the following translation of the search string: ("CIF" OR "Classificação Internacional de Funcionalidade" OR "CIF-CJ") AND (escola OR inclus* OR NEE OR "necessidades educativas especiais" OR "educação especial" OR "Ed Esp").

3.3.2 Screening and selection of studies

The results from the initial database searches were imported into the Mendeley Reference Manager,[1] a free and open-source tool available as both a web and desktop application where duplicates were eliminated and the references were organized (van Biljon et al., 2022). The remaining records were then screened for relevance at the title and abstract level, following the inclusion and exclusion criteria outlined in Table 1. Studies that met the inclusion criteria were retrieved in full text for further evaluation.

3.3.3 Data extraction and synthesis

Data were extracted from the selected studies using four custom-designed extraction forms (described later), standardized for the four languages, using Excel. The forms were designed to capture key information, including study characteristics (e.g., author, year, country), the educational context (e.g., type of school, level of education), the ICF components discussed (e.g., body function and structure, activities and participation), and the specific application of the ICF in each study.

The extracted data from the four protocols were analyzed and then synthesized using a narrative approach, which allowed for the identification of patterns, themes, and differences across the four languages. Particular attention was paid to the cross-language comparisons and the challenges encountered in the application of the ICF in different cultural and educational contexts.

3.3.4 Quality appraisal

While systematic reviews typically include a quality assessment of the included studies, this review focused on providing a broad overview of the existing evidence. As such, a formal

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1 https://www.mendeley.com/reference-management

TABLE 1 Inclusion and exclusion criteria.

Criterion	Inclusion	Exclusion	Justification
ICF focus	Studies focused on the ICF or ICF-CY	Studies focused on other frameworks (e.g., ICD-10)	Ensures relevance to the ICF framework under investigation
Educational context	Studies related to pre-school, primary, secondary, and special education	Studies focused solely on health contexts or higher education	Focuses on educational stages most impacted by ICF application
Language	Published in Chinese, German, Italian, or Portuguese	Studies published in languages other than those specified	Aligns with the study's focus on non-English-speaking contexts
Publication date	Published between 2001 and 2021/2022	Studies published before 2001	Captures the evolution of ICF use in education

quality appraisal was not conducted. However, all included studies were peer-reviewed, which provided a baseline level of methodological rigor.

3.3.5 Reporting and summarizing findings

The findings were summarized in a systematic manner, with results organized by language group. The narrative synthesis highlighted key themes related to the use of the ICF in educational contexts, the differences observed between the language groups, and the challenges associated with implementing the ICF in diverse settings.

The PRISMA flow diagram (Figure 1) details the study selection process, illustrating the number of records identified, screened, and included in the final review.

3.4 Data extraction protocols

The results from the databases were exported and combined using Mendeley reference handling software (Mendeley Ltd., 2020) where they were sorted for duplicates which were removed. Next, the relevant publications that were identified were screened for suitability using inclusion and exclusion criteria, first at abstract level, and then at full-text level. A protocol was designed for each of these two levels, based on discussions with discipline-specific experts and tested amongst the authors. The protocols aimed to ensure that a standardized method was used across the four languages to analyze the publications. The online monthly meetings strengthened this process. Two further protocols were designed to extract information from the selected records, using both a qualitative and semi quantitative content analysis. All steps were systematically documented using Excel.

Protocol 1 was used when reviewing the abstracts. It was used to exclude records that did not meet the inclusion criteria and collect information from records included at the identification phase. Hence, this protocol's eight items included aspects such as record's language, date range, and contents (ICF and/or education-related). The inclusion criteria of Protocol 1 were that abstracts should contain at least one ICF/ICF-CY-related aspect and one education-related aspect.

Protocol 2 was used to review the full text of records that were included during the screening phase to determine eligibility and consisted of a detailed coding scheme constituted of 82 items, covering aspects such as reference type, country of origin, publication year, type of study, research aims and questions, study population, and contents related to education, ICF components

or concepts, and disability. Only publications that contained both education and ICF/ICF-CY components were included; publications that did not meet the inclusion criteria were excluded. For the full-text screening, the authors in each language examined the included publications and made decisions about which to include and exclude.

Protocol 3 was used to extract data from the publications that met the eligibility criteria in Protocol 2. This was a more flexible and open-ended coding scheme developed to extract relevant information that could be used to link the content of the publications to the research questions. Protocol 3 included aspects related to education and ICF components concepts. The Matrix to Analyze Functioning of Education Systems (MAFES) provides a system to organize different types of information reflected in categories that are used at different levels of the education system (Hollenweger, 2010). This matrix provides a comprehensive framework to deconstruct or disaggregate disability categories used in education systems. It helps to understand that the same category can reflect different information depending on the purpose that it is used for. Additionally, it can serve as a communication tool between policy makers, professionals and users to help understand the ways in which disability categories are used in different education systems. Additionally, MAFES enables to establish relationships between different information within a particular education system and to understand how this information is used.

An adapted version of the MAFES was used as a framework to deconstruct the educational levels and analyze where the ICF is used at these educational levels. MAFES breaks educational process into different levels (micro, interactional perspective; meso, organizational perspective; and macro, policy perspective) and into different chronologic perspectives, including input or initial problem (situation); development of an understanding of the problem (assessment); planning for assigning a measure to address the problem (assignment/planning); provision delivery (intervention); and evaluation of the effect of the intervention (outcome) (Moretti et al., 2012).

Protocol 4 also drew on the MAFES (Hollenweger, 2010) and was developed to summarize findings by expanding on critical review methods, focusing on cross-language analysis of the publication contents extracted from the first three protocols. Protocol 4 provided a descriptive summary for each language and combined data in parallel to highlight general patterns in the following areas: publication year, stakeholders mentioned, type of educational setting, and how ICF concepts were used.

FIGURE 1
The PRISMA flow chart showing final results (Page et al., 2021).
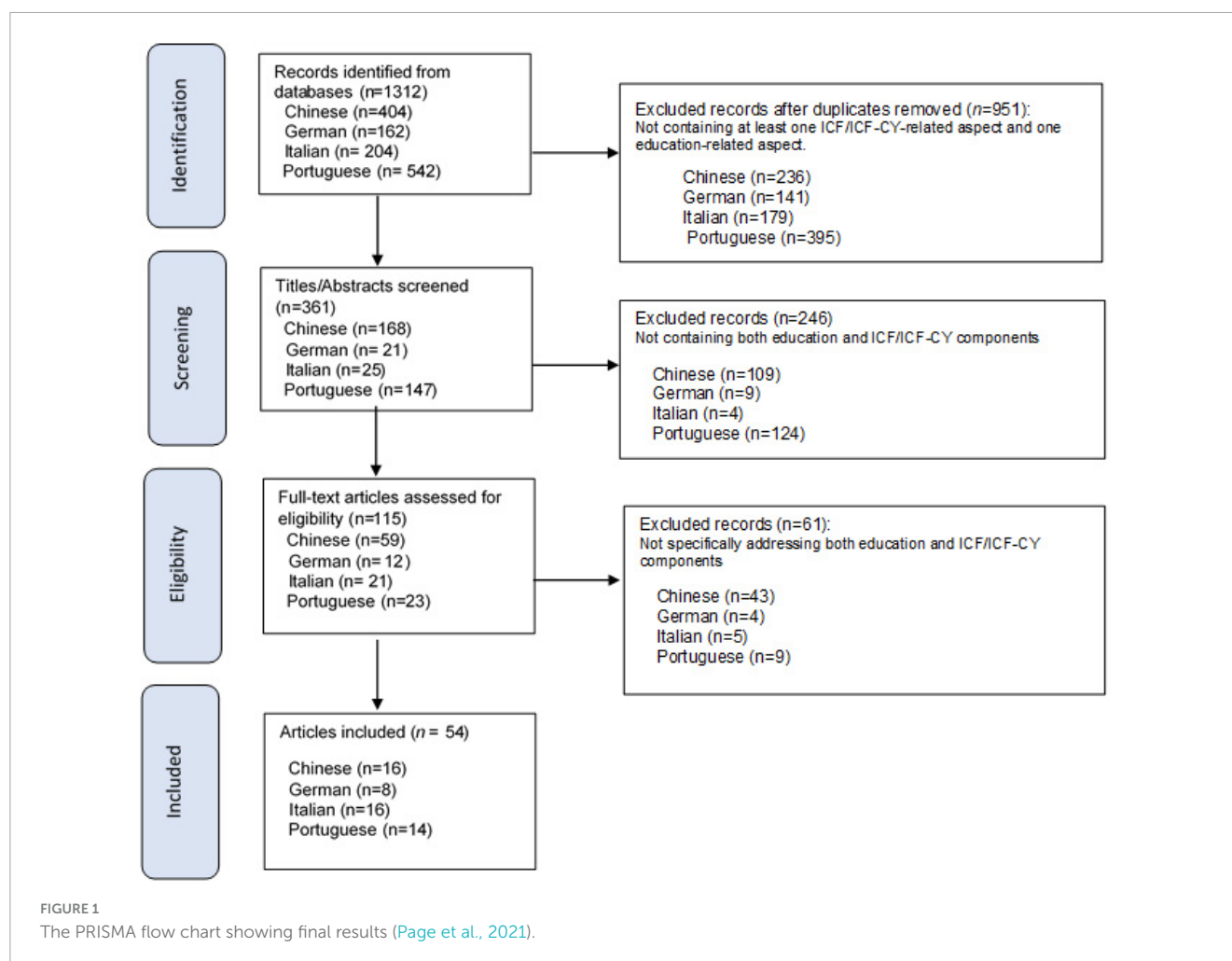
In all steps, researcher triangulation was used to increase the validity and quality reliability of the results (Arias Valencia, 2022). To ensure consistency in and across languages, cross-language comparison was regularly conducted as we developed and refined the four protocols. To achieve this and ensure consistency and consensus, the research group regularly met online, as discussed earlier, and brainstormed solutions to the challenges of comparing data across languages—specifically, the challenges related to the understanding and translation of key concepts (e.g., disability, special needs, etc.) and implementing the search and review criteria.

4 Results

4.1 Cross-language general patterns

The review included 54 publications: 16 in Chinese, 8 in German, 16 in Italian, and 14 in Portuguese. The summary of the included publications is listed in Table 2. The distribution of publications varied across the years, with the highest number of studies published between 2013 and 2017 (Figure 2). All domains of the ICF, i.e., Body Function and Structures, Activities, Participation, Environmental factors, and Personal factors, were addressed in the included literature. Across languages, most of the studies included

activities, participation, and environmental factors. Cross-language differences were noted in the types of educational settings discussed and the stakeholders involved; however, there was a strong focus on the shift from the medical model of disability to a biopsychosocial model, aligning with the ICF's core principle of prioritizing functional abilities over impairments. For example, studies written in Chinese and German were predominantly published in special education journals, while those written in Italian and Portuguese covered a broader range of educational and psychological journals.

4.1.1 Use of the ICF concept

The distribution of the use of the ICF concept across the four languages included in this review is presented in Figure 3. The studies written in Chinese focused primarily on activity and participation, followed by environmental factors. The ICF was used as a theoretical framework for developing assessment tools and guiding special and inclusive education strategies in these publications. The studies written in German focused primarily on participation and environmental factors and the ICF was mostly used as a superficial theoretical framework, with a limited in-depth discussion of its components. Publications tended to focus on specific disabilities within special education. In the studies written in both Italian and Portuguese, the primary focus was on activity and participation, followed by environmental factors. The ICF was emphasized as a tool to support inclusive education, serving as a

TABLE 2 Summary of articles included in this study.

| N	Authors (year)	Language	Country	Aim	Main finding
01	Wu (2021)	Chinese	China	To study sports participation behavior of disabled youth based on ICF theory.	ICF provides a framework for understanding barriers and facilitators to sports participation.
02	Huang et al. (2017)	Chinese	China	To analyze environmental factors for children with disabilities using ICF-CY.	Environmental factors significantly impact the inclusion of children with disabilities.
03	Yang (2016)	Chinese	China	To explore the application of ICF-CY in early childhood inclusive settings.	ICF-CY helps design individualized interventions for inclusive education.
04	Liu et al. (2016)	Chinese	China	To investigate the education status of persons with disabilities in Beijing.	Significant gaps exist in educational access and quality for persons with disabilities.
05	Yang and Cao (2015)	Chinese	China	To implement ICF-CY in individual educational plans (IEPs).	ICF-CY enhances the effectiveness of IEPs by addressing functional and contextual factors.
06	Chen (2015)	Chinese	Taiwan	To reflect on the application of ICF in special education.	ICF promotes a holistic approach but requires further adaptation for educational contexts.
07	Zhang et al. (2014)	Chinese	Taiwan	To develop an activity and participation scale for students with intellectual disabilities.	The scale effectively measures functional outcomes in educational settings.
08	Zhang (2014)	Chinese	Taiwan	To explore the implications of ICF for special education practice.	ICF shifts focus from deficits to functional abilities and participation.
09	He (2013)	Chinese	China	To examine rehabilitation service needs and talent cultivation for people with disabilities.	Diverse rehabilitation services and trained professionals are essential for inclusion.
10	Guo and Yang (2013)	Chinese	China	To apply ICF-CY in autism research and rehabilitation.	ICF-CY provides a comprehensive framework for autism intervention planning.
11	Zhang and Zhuang (2013)	Chinese	Taiwan	To study vocational rehabilitation needs for adults with learning disabilities.	ICF highlights the importance of contextual factors in vocational rehabilitation.
12	He (2012)	Chinese	China	To draw insights from the World Report on Disability for China's disability policies.	The report emphasizes the need for inclusive policies and practices.
13	Chiang and Hong (2012)	Chinese	Taiwan	To discuss the evolution of disability models and the ICF.	ICF represents a shift from medical to biopsychosocial models of disability.
14	Wang (2011)	Chinese	Taiwan	To discuss the implications of ICF and ICF-CY in special education.	ICF-CY supports inclusive education by addressing functional and contextual factors.
15	Lin et al. (2011)	Chinese	Taiwan	To construct learning efficiency indicators using ICF for students with intellectual disabilities.	ICF-based indicators effectively measure learning outcomes for students with disabilities.
16	Huang and Lin (2007)	Chinese	Taiwan	To review Taiwan's special education classification system using ICF.	ICF provides a more holistic framework for classifying disabilities in education.
17	Lang and Sarimski (2019)	German	Germany	To examine social participation of children with visual impairments in inclusive schools.	Teachers identify barriers to social participation, such as limited peer interactions.
18	Spreer et al. (2019)	German	Germany	To study language skills and school performance of children with special educational needs.	Targeted interventions improve long-term language and academic outcomes.
19	Hurschler Lichtsteiner and Wicki (2017)	German	Germany	To develop a kinematic method for analyzing handwriting.	The method supports individualized education planning and effectiveness research.
20	Renner et al. (2015)	German	Germany	To explore the implementation of the UN CRPD in education from parents' perspectives.	Parents highlight systemic challenges in implementing inclusive education policies.
21	Hollenweger (2015)	German	Switzerland	To apply ICF in the context of learning and learning disorders.	ICF provides a holistic framework for understanding and addressing learning disorders.
22	Dworschak (2015)	German	Germany	To analyze contextual factors influencing school support for students with disabilities.	Contextual factors significantly impact the provision of school support.

(Continued)

TABLE 2 (Continued)

N	Authors (year)	Language	Country	Aim	Main finding
23	Stein et al. (2015)	German	Germany	To study behavioral and emotional challenges in vocational training.	Behavioral challenges are prevalent and require targeted interventions in vocational training.
24	Stahnke et al. (2010)	German	Germany	To examine activity and participation of children with reading and spelling difficulties.	Contextual factors significantly influence the daily lives of children with learning difficulties.
25	Pinelli and Fiorucci (2021)	Italian	Italy	To test and monitor an ICF-based individualized educational planning model.	The model effectively supports personalized education for students with disabilities.
26	Pasqualotto and Lascioli (2020)	Italian	Italy	To evaluate the ICF functioning profile in a pilot study.	The ICF profile effectively assesses functional abilities and informs intervention planning.
27	Palumbo et al. (2020)	Italian	Italy	To explore sensory-motor games for children with special educational needs.	Sensory-motor games enhance learning and inclusion for children with disabilities.
28	Moliterni et al. (2018)	Italian	Italy	To evaluate social and civic competences using ICF-CY in physical education.	ICF-CY is a valuable tool for assessing social and civic skills in physical education.
29	Chiappetta Cajola and Traversetti (2018)	Italian	Italy	To examine the role of socio-pedagogical educators in inclusive governance.	Educators play a key role in promoting sustainable and inclusive education systems.
30	Ghedin (2017)	Italian	Italy	To explore the well-being aspirations of students and teachers.	Well-being is a critical component of inclusive education for both students and teachers.
31	De Vita and Rosa (2017)	Italian	Italy	To study motor activity and corporeity in special education.	Physical activity promotes inclusion and holistic development in special education.
32	Zurru (2017)	Italian	Italy	To build an interdisciplinary dialogue on disability using ICF.	ICF fosters a comprehensive understanding of disability across disciplines.
33	Ghedin (2016)	Italian	Italy	To promote inclusion through Biodanza.	Biodanza enhances emotional and social inclusion for students with disabilities.
34	Chiaro (2016)	Italian	Italy	To study the use of educational technologies in teacher training.	Teacher training in educational technologies improves inclusive practices.
35	Chiappetta Cajola and Traversetti (2016)	Italian	Italy	To explore study methods as compensatory measures for students with learning disabilities.	Study methods are effective compensatory tools for inclusion.
36	Aquario et al. (2015)	Italian	Italy	To design inclusive assessment methods for secondary schools.	Inclusive assessment methods improve educational outcomes for diverse learners.
37	Santi (2014)	Italian	Italy	To reflect on the challenges of inclusion in education.	Inclusion requires systemic changes and teacher support.
38	Chiappetta Caiola (2013)	Italian	Italy	To explore the applicability of ICF-CY in early childhood education.	ICF-CY is a valuable tool for early childhood education and intervention planning.
39	Chiaro (2013)	Italian	Italy	To apply ICF-CY for inclusive planning for students with learning disabilities.	ICF-CY supports tailored educational strategies for students with learning disabilities.
40	Benigno and Tavella (2011)	Italian	Italy	Implementing ICT in inclusive learning plans.	ICT enhances engagement and accessibility for students with disabilities.
41	Assis and D'Água (2022)	Portuguese	Brazil	To explore ICF's role in public policies for students with physical disabilities.	ICF informs inclusive policies and practices for students with disabilities.
42	Oliveira et al. (2021)	Portuguese	Brazil	To map the use of ICF in special education.	ICF is widely used but requires further integration into educational practices.
43	Nunes and Lima-Rodrigues (2020)	Portuguese	Portugal	To examine ICF's contributions to functional curriculum design.	ICF supports the development of inclusive and functional curricula.
44	Rocha et al. (2020)	Portuguese	Brazil	To implement ICF in a public special education foundation.	ICF enhances the assessment and planning of educational interventions.

(Continued)

TABLE 2 (Continued)

N	Authors (year)	Language	Country	Aim	Main finding
45	Andrade and Araújo (2018)	Portuguese	Brazil	To study teachers' perceptions of students with physical disabilities using ICF.	Teachers recognize the importance of contextual factors in supporting students with disabilities.
46	Paiva-Alves et al. (2016)	Portuguese	Brazil	To analyze scientific records on ICF-CY for children and youth.	ICF-CY is a valuable tool for early intervention and special education.
47	Pinheiro et al. (2015)	Portuguese	Brazil	To validate an evolutionary profile for students with Down syndrome.	The profile effectively assesses developmental progress in inclusive education.
48	Souza and Alpino (2015)	Portuguese	Brazil	To assess children with spastic diparesis using ICF.	ICF provides a comprehensive framework for assessing functional abilities.
49	Morettin et al. (2013)	Portuguese	Brazil	To use ICF for monitoring cochlear implant patients.	ICF effectively tracks functional outcomes in cochlear implant users.
50	Felizardo and Campos (2013)	Portuguese	Portugal	To reflect on the use of ICF in education.	ICF has potential but requires adaptation for educational contexts.
51	Miccas et al. (2014)	Portuguese	Brazil	To assess functionality in students with autism using ICF.	ICF effectively measures activity and participation in students with autism.
52	Teles et al. (2012)	Portuguese	Portugal	To implement ICF as a reference for classifying special educational needs.	ICF provides a comprehensive framework for classifying educational needs.
53	Siqueira and Santana (2010)	Portuguese	Brazil	To propose accessibility measures for inclusion in higher education.	Accessibility measures are essential for inclusive higher education.
54	Rosário (2009)	Portuguese	Portugal	To explore the utility of ICF-CY in early intervention and special education.	ICF-CY is a valuable tool for early intervention and special education planning

FIGURE 2
Distribution of articles through years and languages.
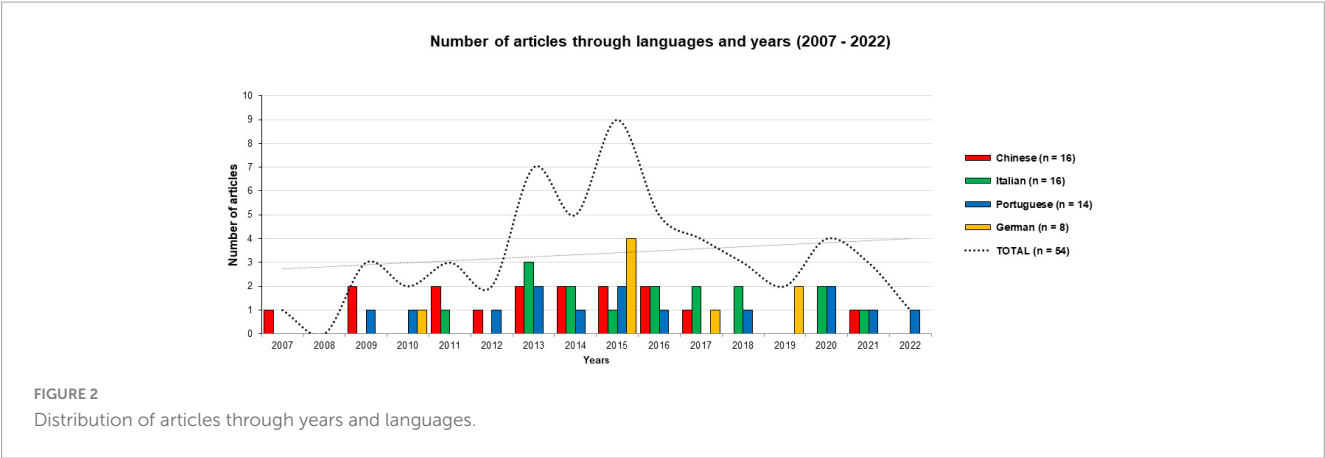
common language, collaborative tool, and theoretical framework, particularly in mainstream educational settings.

4.1.2 Organizational and individual levels
4.1.2.1 Organizational level ("schools")

The distributions of the type of educational setting and school level across the four languages are presented in Figures 4A, B. The publications written in Chinese and German addressed both special and mainstream classes, while those in Italian and Portuguese focused on mainstream education, highlighting the ICF's role in promoting inclusion.

4.1.3 Individual level ("people")

The distribution of the stakeholders mentioned in the literature across the four languages is presented in Figure 4C. Students were the primary stakeholders across publications in all four languages,
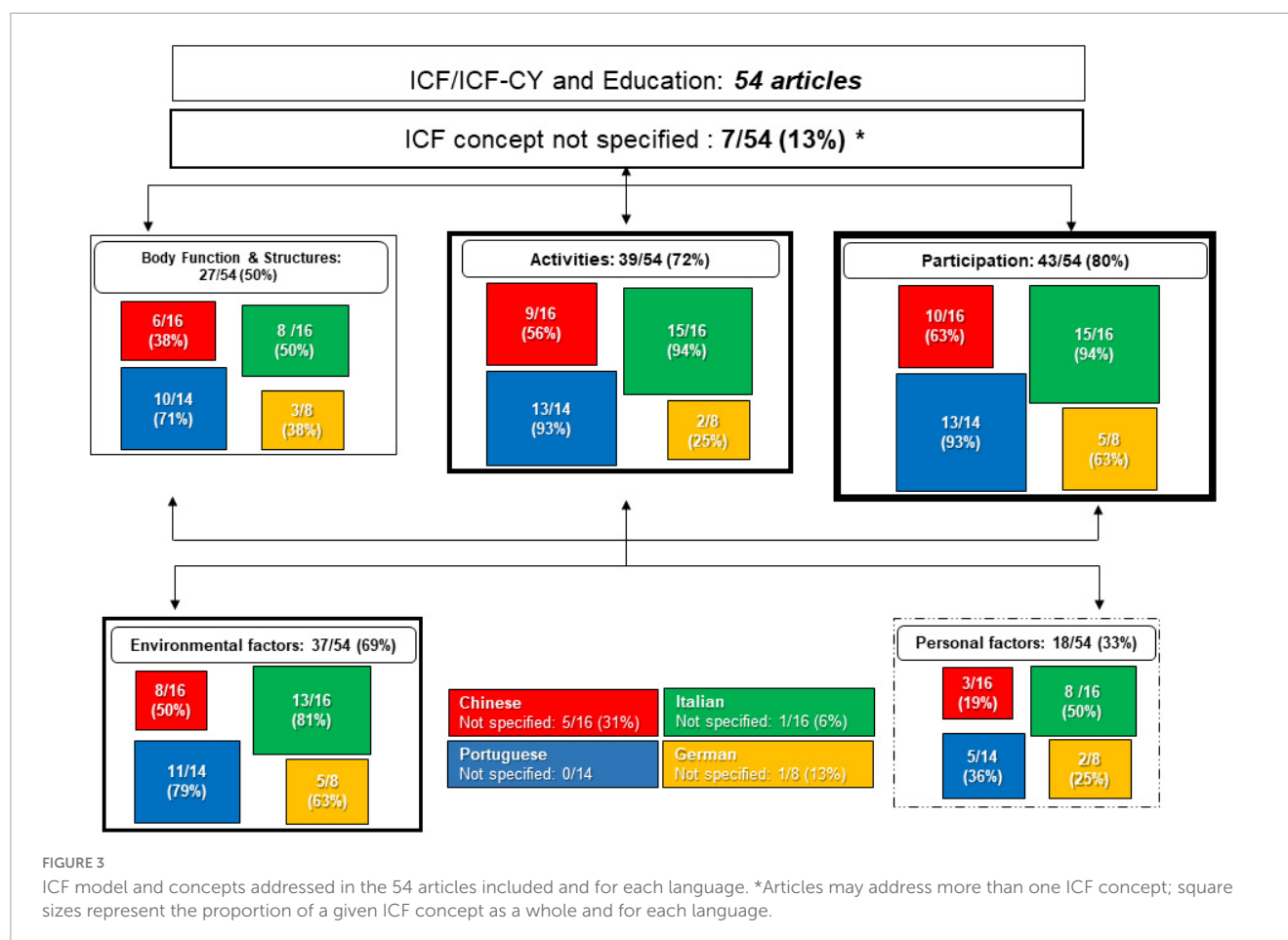
with educators and parents also playing significant roles in some publications.

4.2 Language-specific summary

4.2.1 Chinese
4.2.1.1 General

A total of 16 papers met the inclusion criteria and thus were included for analysis, with primary focuses on the applications on special education and some on inclusive education.

One key theme emerging from the studies published in Chinese is the paradigm shift from the medical model to a biopsychosocial model of disability, as conceptualized within the ICF framework. Huang and Lin (2007) and Chiang and Hong (2012) underscore how the ICF reconceptualizes disability by shifting the focus from

FIGURE 3
ICF model and concepts addressed in the 54 articles included and for each language. *Articles may address more than one ICF concept; square sizes represent the proportion of a given ICF concept as a whole and for each language.

impairment-based classifications to functioning and participation. This shift is further evidenced in Wang (2011), who highlights the ICF's role in transforming special education by promoting a holistic approach that integrates environmental and personal factors into disability assessment. Zhang (2014) and Chen (2015) expand on this perspective, demonstrating how the ICF facilitates a move away from traditional diagnostic labeling toward individualized support and inclusive practices. This stands in contrast to earlier special education models in Taiwan, which primarily adhered to a pathologizing framework of disability (Huang and Lin, 2007).

Another significant contribution of the ICF in the publications written in Chinese is its application in assessment and intervention planning, particularly through the development of individualized education plans (IEPs), assessment tools, and rehabilitation programs. Lin et al. (2011) and Zhang et al. (2014) illustrate how the ICF framework informs the construction of learning efficiency indicators and activity-participation scales for students with intellectual disabilities, providing a comprehensive, function-based approach to educational assessment. Similarly, Yang and Cao (2015) and Yang (2016) examines the utility of the ICF-CY in designing IEPs for students with autism and other disabilities, demonstrating its adaptability across diverse educational settings. This adaptability is further reflected in studies addressing vocational rehabilitation for adults with learning disabilities (Zhang and Zhuang, 2013) and sports participation for disabled youth (Wu, 2021). However, despite these promising applications, Guo and Yang (2013) and Huang et al. (2017) emphasize the complexities of ICF-implementation, citing challenges such as inconsistencies in practical application, insufficient training, and limited institutional resources.

Beyond individual applications, studies published in Chinese also underscore the broader systemic and environmental barriers to inclusion. He (2012) 2013 and Liu et al. (2016) advocate for policy reforms and expanded rehabilitation services to address the diverse needs of individuals with disabilities. Huang et al. (2017) further investigate the sociocultural determinants affecting the inclusion of students with disabilities in mainstream schools, identifying societal attitudes, accessibility limitations, and structural support deficits as key impediments. These findings align with the ICF's emphasis on contextual factors, but they also expose gaps in policy and practice, particularly in relation to educator training and systemic integration of inclusive policies.

4.2.1.2 Use of ICF

Activity and participation are the primary focus. Earlier literature focused on shifting the evaluation from the body function and structures domain to more functional assessments at the activity and participation domains. More recent literature addressed the impacts of environmental factors on activity and participation. Relatively little literature focuses on personal factors.
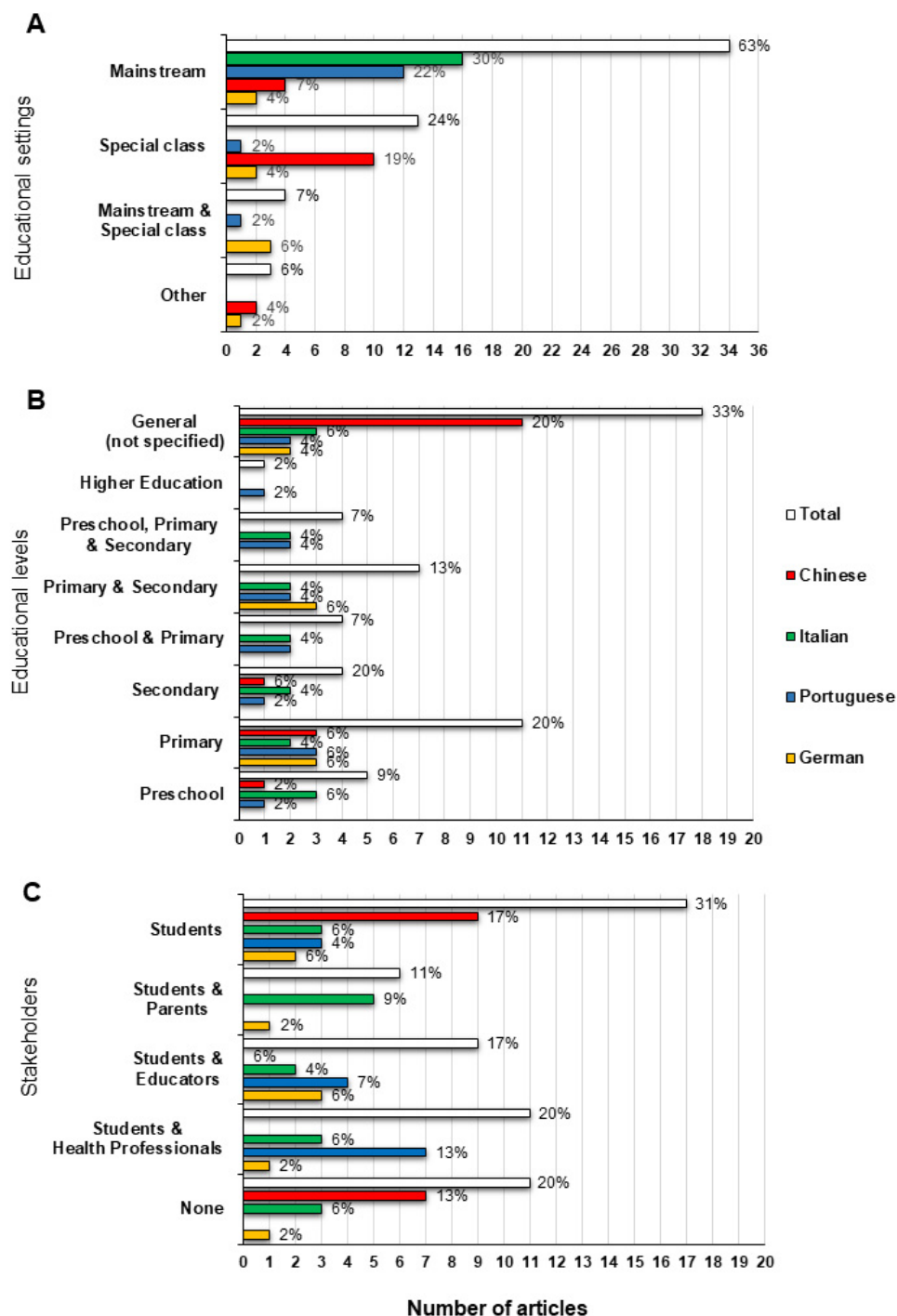
FIGURE 4
Distribution of articles included through educational settings, levels and stakeholders for each language (*n* = 54). **(A)** Articles included according to educational settings and languages. **(B)** Articles included according to educational level and languages. **(C)** Articles included according to stakeholders and languages. Chinese (*n* = 16), Italian (*n* = 16), Portuguese (*n* = 12), German (*n* = 2).

4.2.1.3 Organizational level ("schools")

A few studies addressed the preschool (1), primary (3), and secondary (1) settings. The other publications presented implications for special and inclusive education systems in general. Special classrooms were the main type of educational setting followed by mainstream classrooms.

4.2.1.4 Individual level ("people")

Although most studies proposed applications that could be used for students, families, educators, and policymakers; students were more frequently mentioned as stakeholders. Educators' roles in applying ICF to evaluate students' learning outcomes were occasionally mentioned in a few studies (Lin et al., 2011; Chiang and Hong, 2012).

4.2.2 German
4.2.2.1 General

Only eight publications met the eligibility criteria, in general addressing the application of the ICF framework to better understand and support students with disabilities in educational settings. Hollenweger (2015) highlights the ICF's utility in assessing learning disorders, emphasizing its holistic approach that integrates environmental and personal factors into the evaluation process. Similarly, Stahnke et al. (2010) apply the ICF-CY to analyze activity, participation, and contextual factors affecting primary school children with reading and spelling difficulties, demonstrating how these factors influence their educational experiences and daily functioning. Both studies underscore the ICF's shift from deficits-based to functional-based assessment, reinforcing its role as a framework that prioritizes participation and contextual influences over impairment-focused classifications. While Hollenweger (2015) explores the theoretical and applied dimensions of the ICF in educational contexts, Stahnke et al. (2010) provide empirical evidence on its impact, offering complementary perspectives on the framework's adaptability across research and practice.

Another critical area of investigation in the studies published in German, concerns social participation and the inclusion of students with disabilities. Lang and Sarimski (2019) examine the social integration of students with visual impairments in inclusive primary schools, analyzing teachers' perspectives on barriers such as limited peer interactions and insufficient support systems. Their findings align with Renner et al. (2015), who explored the implementation of the United Nation's Convention on the Rights of Persons with Disabilities (CRPD) in Germany, focusing on the experiences of parents of children using augmentative and alternative communication (AAC) systems. Both studies identified systemic challenges, including insufficient educator training and inadequate resources, which hinder effective inclusion. However, they offer complementary insights, with Lang and Sarimski (2019) concentrating on micro-level school interactions, while Renner et al. (2015) address macro-level policy implications. Together, these studies highlight the need for structural improvements in teacher preparation, school resources, and policy alignment to ensure meaningful participation and inclusion.

Beyond theoretical discussions, studies published in German also explore the effectiveness of specific interventions and assessment tools in special education. Hurschler Lichtsteiner and Wicki (2017) introduced a kinematic method for handwriting analysis, demonstrating its potential for individualized education planning and intervention effectiveness research. Similarly, Spreer et al. (2019) conducted a longitudinal study on the language skills and academic performance of students with special educational needs, emphasizing the long-term benefits of targeted interventions. These findings contrast with those of Dworschak (2015), who investigated the role of contextual factors in securing school support for children with intellectual disabilities, and Stein et al. (2015), who analyzed behavioral and emotional challenges in vocational training using the Achenbach scales. While Hurschler Lichtsteiner and Wicki (2017) and Spreer et al. (2019) focused on specific educational tools and interventions, Dworschak (2015) and Stein et al. (2015) emphasized the broader contextual and systemic factors that influence educational access and outcomes.

4.2.2.2 Use of ICF

Besides one exception, a theoretical concept paper, the ICF addressed personal factors in all the publications. Thus, in the studies published in German, the ICF is mostly used as a theoretical framework and only discussed on a superficial level – for example in mentioning the relevance of interaction between a person and the environment for the concept of disability. Consequently, other relevant concepts such as environmental factors, personal factors, body functions and structures are either not mentioned at all or not discussed in depth. Typical examples generally reference the importance of the ICF's holistic and participation-centered approach without discussing the multifaceted constructs in detail, as is the case in a publication of Lang and Sarimski (2019, p. 227): "According to the ICF, the social participation of visually impaired or blind children is determined both by functional limitations caused by the visual impairment as well as the adaptation and support that the children experience in their environment" (own translation). The superficial use is underscored by the fact that this is the only sentence in the text where the ICF is mentioned.

4.2.2.3 Organizational level ("schools")

Despite the low number of publications, almost all school levels are focused on – starting from the pre-school level and continuing up to vocational (special) education. The school settings involved are almost equally distributed between mainstream and special classes.

4.2.2.4 Individual level ("people")

Throughout all publications, students were the most important stakeholders. Educators and parents are only mentioned peripherally to identify social barriers (Lang and Sarimski, 2019) and policy barriers (Renner et al., 2015) in inclusive education. The aspects related to diversity that are mentioned are remarkably numerous. Nevertheless, the diversity-range is somewhat narrow and includes mainly specific types of disability/SEN such as dyslexia, Down syndrome and cerebral palsy (CP). Only age, gender and social status are outside of this pattern.

4.2.3 Italian
4.2.3.1 General

A total of 16 papers met the inclusion criteria and were thus included for analysis, with the majority focusing on the use of the ICF in mainstream educational settings. A recurring theme across studies published in Italian is the application of the ICF framework in developing inclusive educational practices and IEPs. Chiappetta Caiola (2013) and Chiaro (2013) explored the adaptability of the ICF-CY in early childhood education and for students with specific learning disabilities, emphasizing its potential for tailoring educational strategies. Similarly, Pasqualotto and Lascioli (2020) and Pinelli and Fiorucci (2021) provided empirical evidence on the effectiveness of ICF-based functioning profiles and IEPs in improving outcomes for students with disabilities. These studies align with Moliterni et al. (2018), who applied the ICF-CY to assess social and civic competencies in physical education, showcasing its versatility across different educational domains. However, while Chiappetta Caiola (2013) and Chiaro (2013) focused on theoretical and exploratory applications, Pasqualotto and Lascioli (2020) and Pinelli and Fiorucci (2021)

offered practical validation of the ICF's impact, demonstrating how it serves as a bridge between theory and practice in inclusive education.

Another key area of focus is the role of technology and innovative methodologies in fostering inclusion. Benigno and Tavella (2011) explored the use of information and communication technologies (ICT) in inclusive education, demonstrating their potential to enhance engagement and accessibility for students with disabilities. Chiaro (2016) extended this discussion by analyzing the impact of teacher training in educational technologies, highlighting the need for professional development programs to effectively integrate digital tools into inclusive teaching. These findings are further supported by Palumbo et al. (2020), who advocate for sensory-motor games as a means of supporting students with special educational needs through embodied learning. While Benigno and Tavella (2011) and Chiaro (2016) emphasized digital tools, Palumbo et al. (2020) focused on physical and sensory-based approaches, illustrating the diverse methodologies available to enhance inclusion.

Further than instructional strategies, several studies in Italian address the social and emotional dimensions of inclusion. Ghedin (2016, 2017) investigated the impact of Biodanza and educational well-being programs in fostering happiness and inclusion, emphasizing the importance of social-emotional development alongside academic achievement. Similarly, De Vita and Rosa (2017) highlighted the role of physical activity and corporeity in promoting inclusion, advocating for a holistic educational approach that integrates physical, emotional, and social learning. These perspectives contrast with Santi (2014), who critically examined the challenges of inclusion from the perspective of teacher support, and Zurru (2017), who explored the interdisciplinary potential of the ICF in addressing disability and subjectivity.

4.2.3.2 Use of ICF

The ICF was employed as a common language and collaborative tool in the publications in Italian, particularly in the context of inclusive education. However, discussions on body functions and structures were not as prominent, and these aspects were sometimes not mentioned at all. The focus was mainly on activities and participation, aligning with Italy's inclusive education policies. Environmental factors, such as school infrastructure and educator's attitudes, were also addressed, reflecting the broader context in which education takes place. Despite the strong emphasis on the ICF's utility in promoting inclusive education, there was limited discussion on personal factors, suggesting an area for further exploration in future research.

4.2.3.3 Organizational level ("schools")

All educational levels were discussed, but mainstream classrooms were overwhelmingly the focus, reflecting Italy's strong commitment to inclusive education. The use of the ICF in these settings was predominantly as a framework for assessing and addressing the functional needs of students, rather than for diagnostic purposes. The ICF was seen as instrumental in supporting educators in creating inclusive environments and in facilitating the participation of all students, regardless of their disabilities.

4.2.3.4 Individual level ("people")

Students were the primary stakeholders mentioned across the studies published in Italian, with educators also frequently noted as important actors in the application of the ICF in the pursuit of sustainable and inclusive education systems (Santi, 2014; Chiappetta Cajola and Traversetti, 2018). The diversity of students was generally described in terms of their functional abilities rather than their disabilities, consistent with the ICF's focus on participation and activity. The ICF was used to support the functional assessment of students, helping to tailor educational interventions to individual needs within the inclusive classroom setting.

4.2.4 Portuguese
4.2.4.1 General

A total of 14 papers were included for analysis, addressing the ICF use in all levels of education, mostly in pre-schools and primary schools. A key theme emerging from the studies published in Portuguese is the ICF's role in assessing and classifying disabilities beyond medical diagnoses, facilitating a functional and participatory approach to disability in education. Andrade and Araújo (2018) and Souza and Alpino (2015) examined the ICF's application among students with physical disabilities and spastic diparesis, respectively, demonstrating how the framework promotes a holistic understanding of student needs. Similarly, Miccas et al. (2014) and Pinheiro et al. (2015) explored how the ICF supports students with autism and Down syndrome, providing a structured framework for assessing activities and participation rather than focusing solely on impairments.

Despite its recognized strengths, several studies identify limitations in the practical implementation of the ICF. Felizardo and Campos (2013) argue that, while the ICF provides a comprehensive classification system, its application in educational settings remains conceptually strong but operationally weak. This critique is reinforced by Rocha et al. (2020), who documented institutional barriers to ICF implementation in a public special education foundation, citing challenges such as limited structured training and insufficient teacher familiarity with the framework. Similarly, Oliveira et al. (2021) and Paiva-Alves et al. (2016) emphasized the inconsistent adoption of the ICF in schools, noting that while some countries integrate the ICF into special education policies, others continue to rely on traditional medical classifications.

Another key dimension of the studies published in Portuguese concerns the ICF's role in shaping curriculum design and public policies. Nunes and Lima-Rodrigues (2020) illustrated how functional curricula can better accommodate students with multiple disabilities, facilitating personalized learning pathways. Assis and D'Água (2022) extended this perspective by examining how public policies on professional inclusion for students with disabilities integrate ICF principles, reinforcing the connection between education and workforce integration. Teles et al. (2012) similarly explored ICF's role in classifying special education needs, demonstrating its influence on education management and policy formulation. However, Morettin et al. (2013) and Rosário (2009) raised concerns about institutional inertia, arguing that without strong policy commitments, the ICF's impact remains limited, as many educators and policymakers continue to favor traditional assessment models. A final area of divergence among these studies

pertains to educational levels and accessibility policies. While most research focuses on primary and secondary education, Siqueira and Santana (2010) adopted a unique perspective by examining higher education accessibility, highlighting the ICF's potential role in post-secondary inclusion strategies. This perspective broadens the discussion, suggesting that ICF's applications should extend beyond early education to lifelong learning contexts. Similarly, Rocha et al. (2020) emphasized that, although the ICF has successfully been integrated into some early childhood and special education programs, its application in higher education remains underexplored, underscoring the need for further research and policy adaptations to optimize its effectiveness across all levels of education.

4.2.4.2 Use of ICF

Five theoretical papers, including scoping and systematic reviews, addressed aspects of inclusion within the scope of the ICF model, whether as a theoretical framework, collaborative tool, or common language, to support educators on how to meet their student's needs by considering the ICF components. Some publications focused on using the ICF as a basis for assessment of functioning, evaluating outcomes, or qualitatively approaching students, parents, or educators through interviews with open-ended questions.

4.2.4.3 Organizational Level ("schools")

All educational levels were discussed, and mainstream classrooms were analyzed far more often than segregated/special schools, highlighting the ICF as a support, at least at some level, to the process of inclusive education. This may be recognized by the high number of studies addressing the macro- and meso-levels.

4.2.4.4 Individual level ("people")

Students, followed by educators, were the focus of all included publications. Educators play a key role in supporting students with disabilities in inclusive education (Andrade and Araújo, 2018). The disability type or special need was of little or no importance. This is consistent with the ICF framework's focus on functioning, rather than on the more traditional diagnosis- based or biomedical approach. Most papers applied the ICF by combining its use as a theoretical framework, common language, and a collaborative tool, thus focusing on the functional aspects of students under an inclusive-school environment.

5 Discussion

5.1 Cross-language differences in ICF implementation

Publications on the application of the ICF in special education across studies written in Chinese, German, Italian, and Portuguese, highlight both commonalities and differences. As previously mentioned, studies published in all four languages emphasize the shift from the medical to a biopsychosocial model of disability, focusing on functional abilities rather than impairments. Studies written in Chinese explore this transition through IEPs and functional assessment tools (Huang and Lin, 2007; Wang, 2011),

while studies in Portuguese highlight its role in supporting students with autism spectrum disorder and Down syndrome despite systemic barriers (Miccas et al., 2014; Pinheiro et al., 2015). Studies written in German underscore participation-focused assessments in understanding learning disorders and social integration (Hollenweger, 2015; Lang and Sarimski, 2019), while the studies in Italian emphasize digital learning tools and sensory-motor interventions to enhance inclusion (Benigno and Tavella, 2011; Palumbo et al., 2020). Across all languages, educator training and resource allocation emerged as crucial for effective implementation (Renner et al., 2015; Rocha et al., 2020).

Despite shared goals, variations in application and critique exist. Publications written in Chinese explored ICF adaptability in vocational training and sports participation (Wu, 2021; Zhang and Zhuang, 2013), while studies in Portuguese focused on policy inertia and inconsistencies (Felizardo and Campos, 2013). Studies in German took an empirical approach, examining interventions such as handwriting and language assessments (Hurschler Lichtsteiner and Wicki, 2017; Spreer et al., 2019). Studies published in Italian integrated innovative methods like digital tools and physical activities (Chiaro, 2016; De Vita and Rosa, 2017). Publications in Portuguese also discussed the ICF's role in higher education policy (Siqueira and Santana, 2010), whereas those in German analyzed its alignment with international legal frameworks (Renner et al., 2015). These findings reveal significant cross-language differences that reflect the varying cultural, educational, and policy landscapes in these languages, and possibly the countries in which they are spoken. These differences highlight the adaptability of the ICF framework to diverse contexts, while also underscoring the challenges of ensuring a consistent global application of the ICF in education.

5.1.1 Chinese context: integration and application

In mainland China and Taiwan, the ICF framework has increasingly been integrated into educational practices, particularly in the realm of special education. The literature reveals a strong emphasis on the use of the ICF to shift evaluations from the narrow focus on body functions and structures to a more holistic assessment of activities and participation. This shift aligns with China and Taiwan's broader educational reforms that aim to promote inclusive education. However, the emphasis on environmental factors in more recent literature suggests a growing recognition of the importance of contextual elements in supporting children with disabilities. Despite these advances, the application of the ICF in China and Taiwan remains predominantly within special education settings, with less penetration into mainstream education. This indicates that while the ICF is being used to enhance the quality of special education, there is still work to be done in integrating the framework into the broader educational system. The application of the ICF in education is gradually attracting attention and promotion. The ICF can provide a framework for educational research to guide the direction and effectiveness of special education and inclusive education research, and several research institutions have begun to explore rehabilitation and teaching strategies based on the ICF-framework to improve the quality and effectiveness of special education. As the ICF is increasingly adopted in education, more schools and institutions are focusing

on its concepts and methods. They are working to create an inclusive and accessible learning environment as well as enhancing collaboration among multidisciplinary teams to address the diverse needs of students.

5.1.2 German context: theoretical framework with limited depth

The publications written in German that were analyzed in this review, show a relatively superficial use of the ICF, primarily as a theoretical framework. The ICF is often referenced in discussions about disability, but there is a noticeable lack of depth in exploring its components, such as environmental and personal factors in the educational context. This limited application may be reflective of the countries where German is spoken, namely Germany, Switzerland, and Austria's historically medicalized view of disability, where the focus has traditionally been on diagnosis and treatment rather than on functional assessments and participation. Thus, while the ICF is recognized as a relevant framework, it has not yet been fully adopted and integrated into educational practices. This points to a need for greater awareness and understanding of the ICF's potential to support inclusive education at all levels.

5.1.3 Italian context: emphasis on inclusion

Italy's approach to the ICF is characterized by a strong emphasis on its role in supporting inclusive education. The literature indicates that the ICF is used extensively as a common language and collaborative tool among educators, particularly in mainstream educational settings. This aligns with Italy's long-standing commitment to inclusive education, where students with disabilities are integrated into regular classrooms with support. The use of the ICF to assess functioning and evaluate educational outcomes further demonstrates Italy's progressive approach to education, where the focus is on the student's abilities rather than their disabilities. However, the limited discussion on personal factors in the Italian literature suggests that while the ICF is used effectively to promote inclusion, there may be opportunities to enhance its application by considering a broader range of individual and contextual factors.

5.1.4 Portuguese context: Shifting away from the biomedical model

Similar to Italy, Brazil and Portugal, the only two Portuguese-speaking countries with studies included, have embraced the ICF as a tool for fostering inclusive education. The studies written in Portuguese from both Portugal and Brazil highlight the ICF's role in moving away from a purely biomedical model of disability toward a more holistic approach that considers participation and environmental factors as critical elements of education. This shift reflects broader educational policies from both countries that prioritize students with disabilities in mainstream classrooms. The widespread use of the ICF in pre-school and primary school settings suggests that the framework is being integrated early in the educational process, which is crucial for fostering long-term inclusion. However, like in the studies written in Italian, those in Portuguese could also benefit from a deeper exploration of personal factors, which are essential for tailoring educational interventions to the individual needs of children.

5.2 Challenges in cross-cultural application of the ICF

The review also highlights several challenges in the cross-cultural application of the ICF in education:

1. *Variability in publication patterns.* One of the key challenges identified in this review is the variability in publication patterns across the four languages. The number of ICF-related publications varies significantly, with publications in Chinese and Portuguese showing more consistency over the years, while those in German are relatively sparse. This variability may be attributed to differences in research funding, the prioritization of inclusive education in national policies, and the availability of training for educators and researchers in using the ICF (Paltamaa et al., 2024).

2. *Superficial uptake of implementing the ICF.* The ICF is used only superficially in education, particularly in the publications written in German, reflecting views from Germany, Austria and Switzerland. This limited engagement with the ICF's components suggests that there is a need for more in-depth training and capacity building to ensure that educators and researchers fully understand and utilize the framework. Without a deep understanding of the ICF's potential, its application may remain limited to theoretical discussions rather than being used as a practical tool for improving educational outcomes – an effect also observable in clinical settings (Simon et al., 2024).

3. *Cultural and linguistic adaptations.* The translation and adaptation of the ICF into different languages present another challenge (Üstün et al., 2001). The nuances of certain concepts within the ICF may be lost or altered in translation, leading to differences in how the framework is understood and applied. For example, the concept of "participation" may be interpreted differently in cultures where collective participation is valued differently than individual achievement (Zhu et al., 2024). These linguistic and cultural differences need to be carefully considered when implementing the ICF in diverse educational contexts to ensure that its principles are accurately conveyed and understood.

4. *Integration into inclusive and mainstream education.* While the ICF has been successfully integrated into special education in many contexts, its penetration into inclusive and mainstream education remains uneven. This is particularly evident in the contexts where Chinese and German- are spoken, where the ICF is still primarily associated with special education. Expanding the use of the ICF in mainstream settings is essential for promoting truly inclusive education, where all students, regardless of their abilities, can benefit from a supportive and accommodating learning environment (Leifler et al., 2021).

5.3 Implications for practice and policy

The findings of this review have several implications for practice and policy:

1. *Enhanced training and capacity building.* There is a clear need for enhanced training and capacity building to ensure that educators, policymakers, and researchers fully understand the ICF and its application in education. This training should not only focus on the theoretical aspects of the ICF but also on practical strategies for integrating it into everyday educational practices. Training programs should be culturally and linguistically appropriate, considering the specific needs and contexts of different regions which is particularly relevant for countries with limited ICF adoption. Policymakers can use this evidence to advocate for legislative and educational reforms that integrate ICF principles into special education. Studies in Portuguese highlight barriers such as policy inertia and inconsistent implementation (Felizardo and Campos, 2013; Rocha et al., 2020), while research published in German emphasizes the importance of aligning ICF-based education with global inclusion standards, such as the United Nation's Convention on the Rights of Persons with Disabilities (Renner et al., 2015). Strengthening institutional commitment and linking policies to international frameworks could facilitate more effective adoption of ICF principles. Studies published in German and Italian stress professional development for effective ICF implementation (Hollenweger, 2015; Chiaro, 2016), while these in Chinese highlights its integration into vocational training and rehabilitation (Zhang and Zhuang, 2013; Wu, 2021). Additionally, innovative methodologies like digital learning tools (Benigno and Tavella, 2011) and sensory-motor learning strategies (Palumbo et al., 2020) could support low-cost, technology-driven training solutions. By adapting these international insights, countries with limited ICF adoption can develop effective policies and training programs to foster inclusive education.

2. *Promoting a holistic approach to disability.* The ICF's holistic approach to disability, which considers environmental and personal factors in addition to body functions and structures (Chapireau, 2005), should be promoted more widely in the education context. Educational policies should encourage the use of the ICF as a tool for assessing and supporting all aspects of a student's life, not only their academic abilities. As is the case, for example, in some parts of Switzerland, where the ICF is used as a core concept in a standardized procedure to define learning and development goals for students with special educational needs (Hollenweger, 2011; Hollenweger and Lienhard, 2007). In this procedure, students, parents, teachers, special needs teachers meet at predefined intervals to evaluate the living situation of a particular student in a holistic way, aiming to support the best possible development of their potentials. This approach can help create more inclusive educational environments where all students are valued for their unique contributions.

3. *Cross-cultural collaboration.* Cross-cultural collaboration among educators, researchers, and policymakers is essential for sharing best practices and overcoming the challenges of implementing the ICF in diverse contexts.

Collaborative efforts can lead to the development of culturally adapted versions of the ICF and provide opportunities for learning from different approaches to inclusive education. International forums and conferences can serve as platforms for such collaboration, fostering a global community of practice around the ICF.

4. *Research and policy development.* Further research is needed to explore the long-term impacts of using the ICF in education, particularly in non-English-speaking contexts. This research should focus on evaluating the effectiveness of the ICF in improving educational outcomes for students with disabilities and identifying the factors that contribute to its successful implementation. Policymakers should use this evidence to develop and refine educational policies that support the use of the ICF as a framework for inclusive education.

5.4 Limitations of the study

While this review provides valuable insights into the cross-language application of the ICF in education, it is important to acknowledge its limitations. The review is limited to publications in four languages, excluding English, which means it does not capture the full range of ICF applications in education globally. Some researchers from the included contexts may prefer to publish in English and as a result, their studies were not found in the languages searched. A future study comparing English and non-English publications would be valuable. The staggered approach used during the identification phase could also have impacted the sample by introducing more variation between languages. Additionally, the variability in the availability and quality of publications across languages may have influenced the findings. It should also be acknowledged that the biases of the researchers conducting this study may have influenced the findings – extensive discussions during the many group meetings served as a countermeasure to this issue. This review only included peer-reviewed articles. There may be a high amount of non-peer-reviewed publications focusing on the ICF in the educational field that were therefore not captured, particularly in those published in German- and Chinese where many researchers prefer to publish books or other non-peer-reviewed publications. Future research should therefore aim to include a broader range of languages, contexts, and types of publications along with a focus on time and space (e.g. a longitudinal study) to provide a more comprehensive understanding of the ICF's global impact on education.

6 Conclusion

This review highlights the potential of the ICF as a tool for promoting inclusive education globally. However, its application varies significantly across different linguistic and cultural contexts, reflecting both the strengths and challenges of implementing a global framework in diverse educational settings. To address these challenges effectively, it is crucial that policymakers, researchers and educators engage in sustained international collaboration

and knowledge exchange. This can be achieved through the establishment of global networks and platforms, such as webinars, online forums, joint academic publications, and international conferences, which facilitate ongoing dialogue and resource sharing. Developing and implementing global training initiatives—such as virtual workshops, shared curricula, and cross-cultural training materials—will empower all stakeholders to overcome contextual barriers and ensure the successful implementation of the ICF. In addition to sharing best practices, fostering collaborative international research efforts that explore the challenges and successes of implementing the ICF across different regions (e.g., Africa, see Naude et al., 2024) will help identify research gaps and generate data that can inform policy adjustments and further refine inclusive education strategies.

Author contributions

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