Inclusive education and interdisciplinary approaches to the environment, pedagogical support, and social development: a systematic review

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Abstract

Background and Study Aim	Inclusive education is increasingly regarded as a priority for ensuring equal opportunities for learning and development among all participants in the educational process. Despite growing attention, inclusive education still lacks interdisciplinary integration, particularly in spatial and pedagogical dimensions. The aim of this study is to systematize the thematic structure of contemporary literature on inclusive education using Latent Dirichlet Allocation (LDA) modeling.
Material and Methods	The Web of Science database was used in this study. The search covered the past five years and included only English-language articles. An initial keyword search yielded 791 publications, from which 661 were extracted. The PRISMA 2020 methodology and LDA modeling were applied to these 661 publications to identify thematic clusters (topics). The optimal LDA model featured the following parameters: coherence score = 0.4467, perplexity = −7.0425. Data processing of the extracted documents was carried out in the PyCharm environment using custom Python scripts.
Results	It was identified terms typical for environmental design (n = 62), inclusive and educational environments (n = 85). It was excluded terms used in non-relevant contexts (n = 10). Based on the extracted terms and 661 documents, a set of single words (n = 50) and word pairs (n = 225) with their respective weights was created. Using the WeightedPairCount metric, 29 of the most relevant publications were selected. Pedagogical support was the most frequently discussed topic (41.4% of the sample), followed by environmental design (27.6%), emotional development (17.2%), and assessment tools (13.8%). For each area, current challenges, barriers, and promising approaches were identified.
Conclusions	The systematization of current research on inclusive education enables the structuring of accumulated academic knowledge and highlights existing gaps. Future studies should prioritize interdisciplinary approaches that integrate pedagogical, environmental, and technological components.
Keywords:	educational environment, universal design, environmental design, sensory adaptation, digital visualization, inclusive culture, social integration, school climate, inclusion.

Glossary

Inclusive education – education that takes into account the needs of all learners, including children with disabilities.

Inclusive design (universal design) – design of environments to be accessible and usable by everyone without the need for additional adaptation.

Pedagogical support – methods, strategies, and conditions that facilitate successful learning for all student groups.

Emotional integration – creating a classroom atmosphere of acceptance, safety, and psychological comfort.

Topics – stable semantic groups in academic texts, automatically identified using topic modeling.

LDA (Latent Dirichlet Allocation) – a text analysis method that identifies topics based on word usage statistics.

Coherence score – a numerical measure of topic

quality; higher values indicate more clearly defined semantic clusters.

Perplexity – a measure of model complexity; used to assess its accuracy.

PyCharm – a programming environment used to run analysis scripts (e.g., in Python).

WeightedPairCount – the sum of word pair weights in a topic; used to assess its importance within the text.

Introduction

Inclusion in education is regarded as a multifaceted phenomenon encompassing pedagogical practices, social interactions, and physical and digital environment of the educational process. Particular emphasis is placed on environmental solutions aimed at creating accessible, flexible, and supportive climate. Such environments take into account the diverse sensory, cognitive, and behavioral characteristics of learners. Despite a growing theoretical and practical foundation, the implementation of these solutions remains challenged by factors such as the resource-intensive nature of adaptations and the insufficient coherence of interdisciplinary approaches. The diversity of research directions highlights the need to identify evidence-based and context-sensitive solutions.

In this context, particular attention is given to studies that reveal the foundational principles of inclusive education. For example, the work of Ioannidi and Malafantis highlights the importance of incorporating diversity into the content and forms of assessment as a basis for equal access to learning [1]. The study by Jardinez and Natividad emphasizes the role of Universal Design for Learning and the need for teacher training to effectively implement inclusive approaches [2]. Florian and Beaton propose the concept of inclusive pedagogy as a systemic approach aimed at the active participation of all learners, rather than merely adapting to the needs of specific groups [3]. Additionally, the study by Lawrie et al. underscores the importance of institutional support, the rethinking of curricula, and assessment methods as essential components of a sustainable inclusive environment [4]. Furthermore, the inclusive pedagogy model proposed by Florian and Beaton [3] aligns with the need for a systemic rather than compensatory review of existing practices. Ultimately, these studies provide a theoretical foundation for analyzing the key areas covered in the present review.

Theme 1: Inclusive Education and Pedagogical Support

Pedagogical support in inclusive education is regarded as an essential component that ensures the active participation of all learners. In particular, the concept of inclusive pedagogy emphasizes the need to shift from individual adaptation strategies toward creating a shared learning environment that includes all children without exception [5]. Loreman's study draws attention to the importance of teachers' positive attitudes, their professional training, and adequate institutional support as key factors for successful inclusion [6]. Similarly, the work of Walton and Rusznyak highlights the significance of pedagogical reflection and justice in decision-making processes aimed at fostering the inclusive potential of educational practice [7]. These studies provide a scholarly foundation for analyzing the strategies, barriers, and prospects of pedagogical support in inclusive environments.

At the same time, researchers emphasize the development of co-teaching strategies, differentiated instruction, and professional support for educators. Studies highlight the importance of fostering an inclusive climate and implementing digital solutions to adapt the learning process [8]. However, challenges are also noted, including insufficient teacher preparation and a superficial understanding of the concept of inclusion [9, 10]. Key recommendations include revising curricula, developing professional communities, and integrating digital tools [11]. Thus, the conceptualization of inclusive education requires a comprehensive and interdisciplinary approach that integrates pedagogical, psychological, and administrative dimensions.

Theme 2: Spatial Organization of Inclusive Environments and Interior Design

Issues of spatial organization in inclusive environments are attracting increasing attention from researchers aiming to create educational spaces that support equal participation for all. According to Imrie, the physical environment has a direct impact on inclusion and therefore must be adapted not only to physiological needs but also to the sensory and emotional characteristics of learners [12]. Additionally, the studies by Woolner and Clark emphasize the importance of involving users – students and teachers – in the design process of inclusive spaces, which fosters a sense of belonging and support [13]. A significant contribution is also made by the study of Byers and Imms [14], who present empirical data on the impact of flexible architecture and furniture on the engagement and learning behavior of children with diverse needs. Collectively, these publications lay the groundwork for rethinking inclusive design as an interdisciplinary endeavor integrating pedagogy, architecture, and social justice.

An analysis of other studies highlights the growing development of approaches to designing inclusive spaces with attention to multisensory experience, ergonomics, and digital technologies [15]. Several works emphasize the importance of personalized environments and interdisciplinary collaboration between architects, educators, and sensory

integration specialists [16]. The use of VR tools and automated planning algorithms such as EDU-AI is expanding access to inclusive environments under limited resource conditions [8, 17].

Thus, spatial inclusion is viewed as a vital component of the educational process, requiring a shift from formal accessibility requirements toward the creation of flexible, adaptive, and empathetic learning spaces.

Theme 3: Emotional and Social Development of Students in Inclusion

Studies on the emotional and social development of students in inclusive environments emphasize that their well-being is closely linked to a supportive classroom atmosphere. One of the most frequently cited works in this field is the study by Schwab, which demonstrated that perceived social inclusion of students with disabilities is significantly influenced by a positive classroom climate and the level of teacher engagement [18]. Similar findings are presented in the research by Avramidis and Norwich [19], who highlight the role of teacher attitudes and competencies in ensuring emotional safety and social integration of students with special educational needs. Additionally, the study by De Boer et al. shows that positive peer perception among students with special needs significantly affects their participation in joint activities and their self-esteem [20]. The authors emphasize that teacher support acts as a mediator of this effect.

Emotional well-being and a sense of belonging are recognized as crucial conditions for successful inclusion. Schwab's research confirmed that perceived social inclusion is directly associated with a supportive classroom climate and teacher involvement [18]. Another study highlights the importance of developing teachers' interpersonal competencies and cultural sensitivity within inclusive settings [21]. The potential for co-developing inclusive norms with students' participation is also noted as a tool for overcoming social hierarchy [22].

Thus, the analysis of these studies underscores the significance of the psycho-emotional dimension of inclusive education. It also highlights the role of the teacher as a mediator of social relationships and reveals the importance of cultural and age-specific contexts in designing inclusive strategies.

Theme 4: Analytical Tools and Systematic Reviews of Inclusive Practice

Contemporary research emphasizes the importance of applying systematic and reproducible approaches to the analysis of inclusive educational practices. For example, the work of Mitchell summarizes evidence-based strategies for inclusive teaching [23], highlighting the integration of empirical data in the development of effective pedagogical approaches. In a systematic review,

Sharma et al. [24] demonstrate the need for teacher training and structured assessment of institutional readiness for inclusion, including the evaluation of attitudes, resources, and administrative support. In turn, Black-Hawkins [25] introduces the concept of "inclusiveness indicators," enabling researchers and practitioners to apply universal criteria when monitoring inclusive initiatives in educational institutions. Such approaches form a foundation for comparative analysis, support the transformation of educational policy, and enhance interdisciplinary connections in the field of inclusive education.

Other studies reflect researchers' efforts toward comprehensive evaluation of inclusion effectiveness through systemic frameworks and international experience [26, 27]. Special attention is given to the adaptation of strategies to cultural and organizational contexts [28, 29]. Some publications underscore the importance of institutional readiness to implement inclusive technologies even under crisis conditions, including remote and telemedical solutions [30].

In general, the analysis of research findings shows that inclusive education is regarded as a multidimensional phenomenon. This approach encompasses pedagogical strategies, spatial organization of learning environments, emotional development, and institutional support mechanisms. The reviewed authors emphasize the importance of rethinking the teacher's role, enhancing professional preparation, and developing flexible architectural and digital solutions. The studies also point to the significant influence of a positive climate and social engagement on student well-being. Although previous research has explored inclusive pedagogy, few studies have systematized the interdisciplinary spatial-pedagogical themes in empirical literature. In this context, there is a clear need to eliminate fragmentation in addressing spatial, emotional, and institutional aspects of inclusion across different disciplines.

Based on the conducted theoretical and contextual analysis, the following research questions were formulated:

– What dominant thematic clusters are represented in contemporary publications on inclusive education?

– How spatial, pedagogical, and emotional aspects are interconnected in the reviewed sources?

Research Aim. To identify and analyze the key thematic directions in contemporary academic literature on inclusive education using Latent Dirichlet Allocation (LDA) topic modeling, with a focus on pedagogical, spatial, and emotional components.

Methodology

The structure of the systematic review adheres to the core criteria of PRISMA 2020, ensuring

transparency and reproducibility of the results (Figure 1).

Information Sources

Publications from the Web of Science (WoS) database were used as the information source. The search covered the last five years and included only articles in English. The initial search was based on two categories of keywords:

1. First category – Object-related terms: "resource room" OR "learning resource room" OR "inclusive classroom" OR "special education classroom" OR "support classroom" OR "sensory room" OR "resource center". Search result: 791 documents.

2. Second category – Synonyms and related terms for development, design, and creation: design* OR redesign* OR "co-design*" OR "pre-design*" OR "post-design*" OR develop* OR creat* OR construct* OR implement* OR plann* OR architect* OR model* OR prototyp* OR concept* OR structur* OR schem*. Search result: 661 documents.

All 661 documents identified during the search were exported into a text file with all associated keys.

Research Methods

To enhance the transparency of the analysis, the research methods were structured as follows:

(1) extraction of publications based on keyword search;

(2) manual and automated filtering according to relevance criteria;

(3) semantic analysis using the LDA algorithm and visualization of term graphs.

Study Design

Procedure for Selecting the Most Relevant Publications

The selection of relevant documents was performed automatically in accordance with the recommendations by Yermakova [31, 32].

The text file containing 661 documents was cleaned of irrelevant information and converted into a more analysis-friendly format (CSV). The resulting table contained two columns: "Identifier" and "Combined Data" (title, abstract, and keywords).

For further analysis, keyword (term) tables were generated. The keyword groups were developed based on the spatial, pedagogical, and institutional aspects of inclusion.

The table 1 included terms (n = 62) that reflected design and construction activities typical of environmental design topics. It included words with the root "design" and its derivatives, as well as lexemes related to development, creation, architectural modeling, and structural planning (e.g., develop, create, construct, implement, plan, architect, model, prototype, concept, structure, scheme).

The table 2 included terms (n = 85) denoting types of rooms and spaces typical for inclusive and educational environments (e.g., resource room, inclusive classroom, sensory room, etc.). These expressions reflect the specifics of architectural and spatial organization in the context of inclusive and special education.
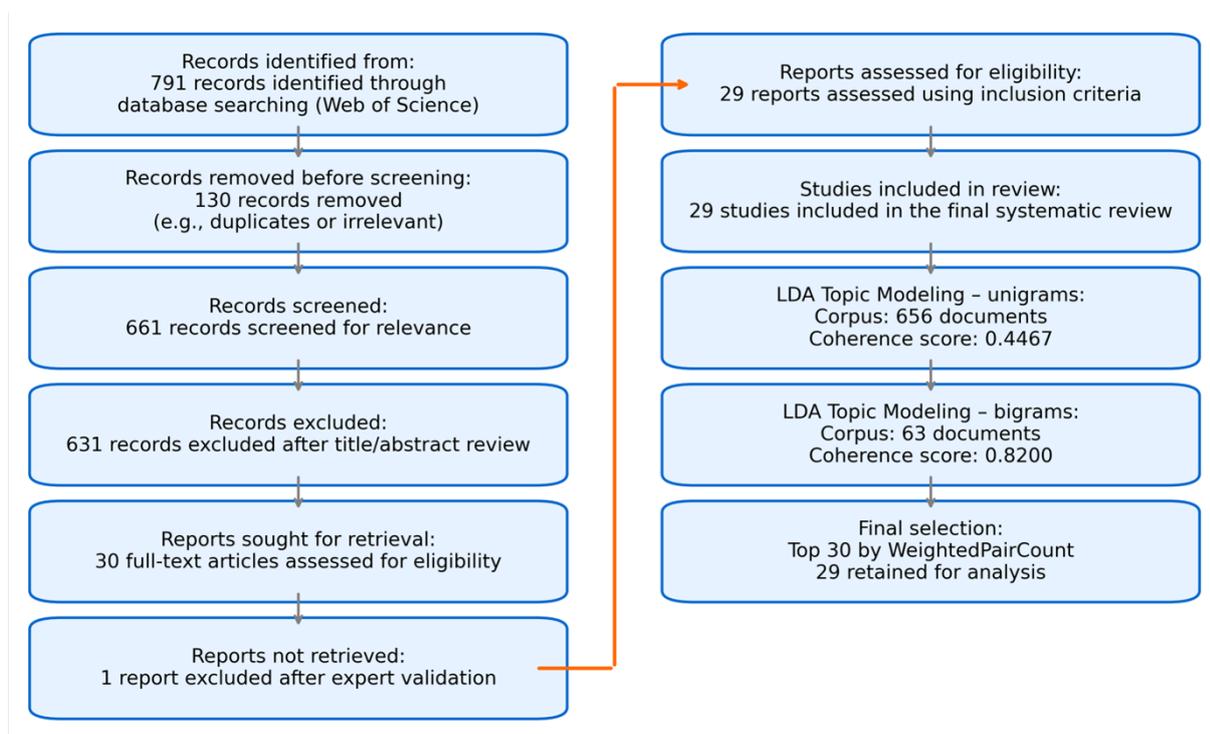

Figure 1. PRISMA flow diagram with LDA topic modeling results.

Table 1. Terms Reflecting Design and Construction Activities

Term	Term	Term	Term	Term
architect	constructing	designer	implemented	pre-design
architects	construction	designers	implementing	prototype
architectural	constructive	designing	model	prototyped
architecture	constructor	designs	modeled	prototypes
co-design	create	develop	modeling	prototyping
concept	created	developed	modelling	redesign
concepts	creating	developer	models	schematic
conceptual	creation	developers	plan	schematized
conceptualization	creative	developing	planned	scheme
conceptualize	creativity	development	planning	schemes
construct	design	implement	plans	structural
constructed	designed	implementation	post-design	structure

Table 2. Terms Denoting Types of Rooms and Spaces

Term	Term	Term	Term	Term
accessibility	chambers	floorplan	roomed	spacing
accessible	compartment	floorplans	roomful	spacious
adaptive	compartments	function	rooming	spatial
aesthetic	configuration	functionality	roomless	spatiality
aesthetics	configurations	interior	roomlike	subzone
ambience	enclosure	interiority	rooms	unified
ambiences	enclosures	interiors	section	unit
area	environment	layout	sectioned	unitized
areal	environmental	layouts	sectioning	unitizing
areas	environmentally	modular	sections	units
atria	environments	open-plan	set	usability
atrium	facilitate	plan	setting	volume
blueprint	facilitated	planning	settings	volumes
blueprints	facilitating	plans	space	zone
chamber	facilities	preset	spaced	zoned
chambered	facility	reset	spaceless	zones
chambering	flexible	room	spaces	zoning

Table 3. Terms Used in Non-Relevant Contexts

Term	Term
design of experiments	concept car
design thinking in marketing	resource extraction
resource allocation	architecture of computer systems
support vector machine	prototype vaccine
data modeling	planning algorithm

The table 3 contained a list of terms (n = 10) that are formally similar to the keywords in Tables 1 and 2 but were used in non-relevant contexts. It included phrases that formally contain key roots (e.g., design, room, space), but are unrelated to the themes of environmental design or the organization of educational environments. Examples of such expressions include: *design of experiments*, *resource allocation*, *support vector machine*, *concept car*, and others.

The processing of the term tables and the table of 661 documents made it possible to generate new

Table 4. Set of Single Words (n = 50)

Topic	Word	Weight	Topic	Word	Weight	Topic	Word	Weight	Topic	Word	Weight	Topic	Word	Weight
1	development	0.2708	2	model	0.3351	3	room	0.2134	4	inclusive	0.4492	5	area	0.155
1	including	0.1083	2	concept	0.0603	3	environment	0.1018	4	inclusion	0.1104	5	plan	0.09
1	function	0.0737	2	structure	0.0531	3	space	0.0941	4	design	0.0673	5	implementation	0.076
1	setting	0.0699	2	set	0.0513	3	unit	0.0695	4	environment	0.0578	5	structured	0.0644
1	developing	0.0637	2	design	0.0505	3	developed	0.0536	4	setting	0.0309	5	development	0.063
1	developed	0.0393	2	inclusion	0.0424	3	environmental	0.0527	4	create	0.0255	5	included	0.0607
1	design	0.0385	2	development	0.0307	3	design	0.036	4	facility	0.0168	5	created	0.0579
1	include	0.038	2	including	0.0233	3	included	0.0302	4	designed	0.0151	5	implementing	0.033
1	creating	0.0308	2	implementation	0.0225	3	designed	0.0267	4	modeling	0.0147	5	planning	0.0323
1	environment	0.0286	2	developed	0.0222	3	setting	0.0248	4	implementation	0.0145	5	develop	0.0313

tables indicating the weight of each word:

– Single-word table (n = 50), showing the weight of each word, distributed across Topics 1–5.

– Word pair table (n = 225), indicating the weight of each word pair and their corresponding topics. This table contains word pairs extracted from Table 4. For each pair, the total weight and the assigned topic are provided. Example format:

• development → including → 0.1895538 → 1
• model → concept → 0.1976960725 → 2
• room → environment → 0.157610945 → 3
• inclusive → inclusion → 0.279800545 → 4
• plan → planning → 0.0611436105 → 5

Topic Modeling

To analyze publications related to design, inclusivity, and spatial organization, a topic modeling procedure was implemented using the Latent Dirichlet Allocation (LDA) algorithm. The choice of LDA was based on its high efficiency in processing unstructured texts [33] and its applicability in the fields of humanities and pedagogical research [34, 35].

The analysis was conducted in two versions: using single keywords and using pairs of stable word combinations extracted from pre-cleaned texts.

The first dataset included 656 texts and produced a vocabulary of 9,936 unique words. The optimal LDA model generated topics with the following values: coherence score = 0.4467, perplexity = −7.0425, indicating moderate structure and topic diversity.

In the second approach, the analysis was based on keyword pairs weighted according to importance, which allowed the identification of semantically stable connections, such as *development plan*, *function including*, and *resource room*. This corpus consisted of 63 texts and 22 unique term pairs. The five-topic LDA model in this case demonstrated high quality: coherence score = 0.8200, perplexity = −3.3161, indicating well-defined and interpretable topics.

The comparison showed that the use of keyword pairs ensures greater topic clarity and relevance of results.

Based on the calculated WeightedPairCount index, 30 of the most relevant publications were selected. During subsequent expert validation, one of these publications was found to be unrelated to the research topic and was excluded from the final analysis. Thus, the proportion of mistakenly included publications amounted to 3.3%, which falls within the acceptable selection error threshold (up to 5%) recognized as permissible in pedagogical research. This confirms the reliability of the automated document selection method used.

Justification of the Sample Size (n = 30)

To justify the sample size in the qualitative thematic analysis, a heuristic $\sqrt{N}$ approach was applied, which is recognized as acceptable in methodological literature. In particular, Lakens notes that heuristic strategies (including $\sqrt{N}$) are a valid way to justify sample size in studies where traditional statistical criteria are not applicable [36]. Moreover, according to a systematic review of studies in medicine and social sciences, a range of 20–30 cases is considered sufficient to achieve thematic saturation – a state in which new data no longer provide substantial new information [37]. Additionally, applied studies also use the heuristic $k \approx \sqrt{n}$ to select a representative subset from large datasets. This is supported in the work of Tarrazo, where the $\sqrt{N}$ rule is used to optimize element selection in portfolio modeling [38]. Therefore, given the total corpus size of 656 documents, the value $\sqrt{656} \approx 25.6$ serves as a justification for selecting 30 publications, which is both methodologically sound and practically manageable for in-depth analysis.

During the topic modeling process using the LDA algorithm, five topics were identified based on the distribution of key terms. However, only four of them were included in the substantive analysis. Following expert interpretation and thematic relevance verification, it was decided not to include the fifth topic in the content analysis. The fifth topic was excluded because most of the publications associated with it addressed administrative, infrastructural, or organizational-management aspects that were only weakly related to the objectives of the present study.

Unlike Topics 1–4, the materials under Topic 5 did not align with the main focus of the systematic review.

The distribution of publications across topics demonstrates the dominance of publications related to pedagogical support, highlighting the significance of this area in inclusive education research (Table 5).

Table 5. Distribution of Publications by Identified Topics

Topic	Number of Publications	% of Sample
Pedagogical Support	12	41.4%
Spatial Environment	8	27.6%
Emotional Development	5	17.2%
Analytical Tools	4	13.8%

Statistical Analysis

Data processing of the extracted documents was carried out in the PyCharm environment using custom-developed Python scripts with the integration of relevant libraries. The accuracy of the scripts was verified through manual validation of the sample and replication of procedures by two independent members of the research team. The consistency of the results confirms the reproducibility and reliability of the automated operations.

The scripts and processed data can be provided upon request, subject to compliance with academic ethics and licensing restrictions of the original sources.

Results

To visualize the semantic relationships between terms appearing in the publication corpus, a weighted undirected graph was constructed (Figure 2). The graph nodes represent keywords, while the edges indicate stable word pairings based on the frequency and significance of their co-occurrence in the texts. The edge weight corresponds to the degree of associative relevance of the word pairs and was used to scale the thickness of the lines in the diagram. Color coding was applied to distinguish edges by significance level: red for highly significant connections (above 0.7), blue for moderate significance (0.4 to 0.7), and green for lower significance (below 0.4). The visualization was performed using the *networkx* library, with node positioning determined by the spring layout algorithm. The final graph diagram illustrated the most relevant thematic associations between terms
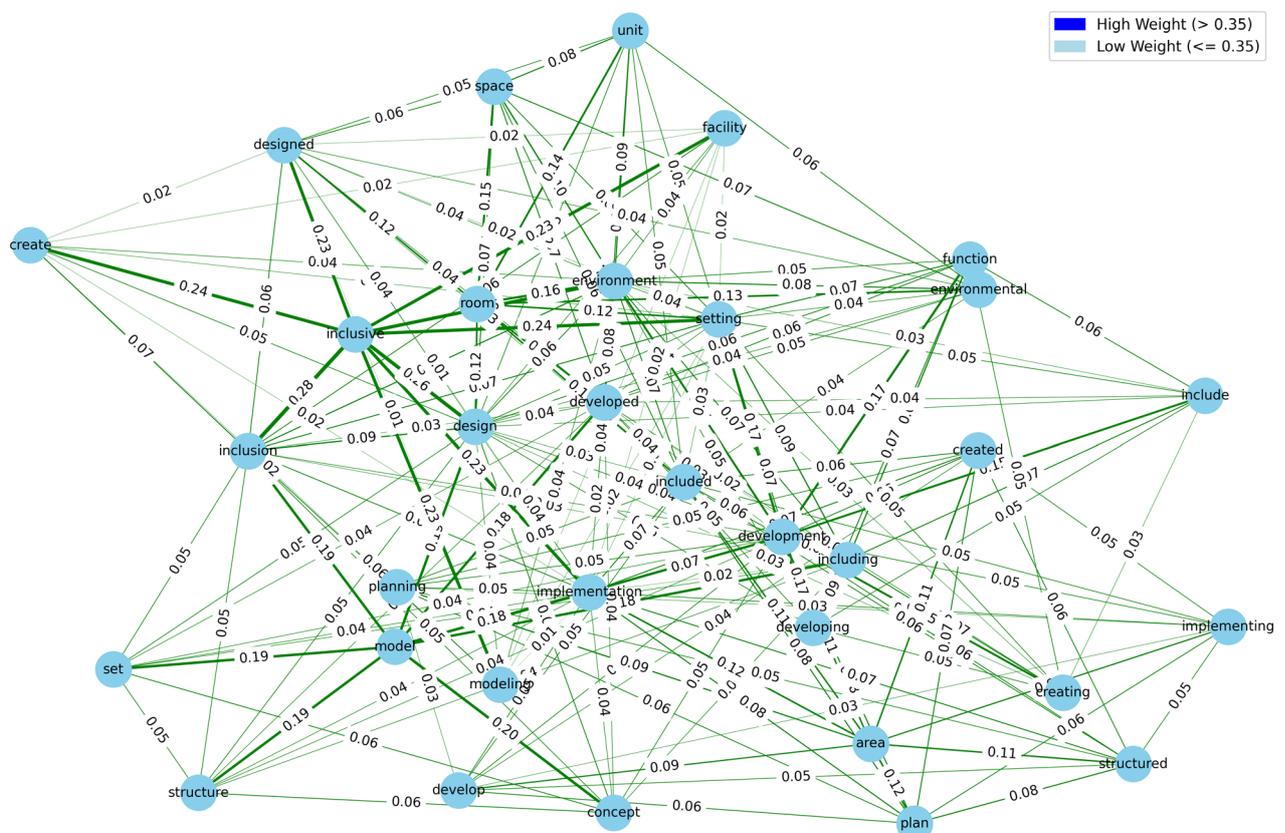

Figure 2. Weighted graph of keyword pairs showing semantic relationships between terms used in the analysis of publications on design and educational spaces. Note. A weighted graph is a graph in which each edge is assigned a numerical value reflecting the strength of the connection between two terms.

within the studied subject area.

The graph (Figure 2) reflects thematic clusters, with particularly prominent links related to development and inclusion (e.g., the pairs "development–including" and "inclusive–inclusion"). These clusters form the core of the semantic field, around which other significant concepts are organized. In particular, within the topic of pedagogical modeling, strong associations emerged among the terms "model," "concept," "approach," and "strategy," indicating the frequent use of these terms in the context of educational program development. In the inclusion cluster, stable pairings such as "inclusive–inclusion," "support–needs," and "access–barrier" demonstrate a focus on accessibility and support issues.

As a result of thematic analysis and ranking by weighted keyword pair counts, 29 of the most significant publications were selected (Table 6).

A comparative analysis of publications on Theme 1 reveals a stable thematic core centered on the development of educational strategies aimed at supporting inclusion. Common directions include the creation of inclusive classrooms, integration of digital tools, as well as the implementation of collaborative and differentiated instruction. Systemic barriers frequently identified a lack of pedagogical competencies, limited institutional support, and insufficient integration of the inclusion concept into educational policy. General recommendations encompass the revision of educational programs, support for professional development, strengthening of professional communities, and the use of ICT. Several studies emphasize the importance of contextual factors, such as teacher professional identity and school organizational culture, as conditions for sustainable inclusive transformation.

The general analysis of publications on Theme 2 points to the emergence of an interdisciplinary research field that combines pedagogical, architectural, and technological approaches to designing inclusive educational environments. Key concepts include sensory adaptation, ergonomic design, and flexible space organization. Spatial solutions are considered not only functional but also pedagogically meaningful components that support individualized learning and foster social interaction. Major challenges include the lack of unified inclusive design standards, as well as the need to consider cultural contexts and the diversity of needs. The necessity of cooperation among architects, educators, and sensory integration specialists is substantiated in the development of spaces aligned with the principles of universal design and inclusivity.

The general analysis of publications on Theme 3 shows that emotional well-being and the quality of the social climate are considered key determinants of successful inclusion. The effectiveness of inclusive practice is directly linked to the level of empathy, cultural sensitivity, and interpersonal competence of educators. A positive emotional environment helps reduce anxiety and fosters stable self-esteem in students with special educational needs. Studies emphasize the importance of co-creating inclusive norms, which not only enhances the engagement of all participants but also transforms hidden forms of social hierarchy. The perception of inclusion is noted to vary depending on age, gender, and group cohesion level, highlighting the need to consider socio-psychological factors when designing educational environments.

Additionally, several publications underline that the sustainable development of an emotionally safe environment requires both individual teacher competencies and institutional support. This approach is implemented through psycho-pedagogical support programs, the integration of inclusive culture into the school mission, and the involvement of parents and external experts. Empirical data demonstrate a connection between school climate and the level of social engagement, particularly in adolescent settings. There is also growing interest in tools for assessing emotional inclusion, such as perception of inclusion scales, emotional climate indices, and surveys on perceived fairness and belonging.

Cumulative analysis of publications on Theme 4 demonstrates a shift in research focus from describing inclusive initiatives to systematically evaluating them using both quantitative and qualitative methods. Key trends include the use of international comparative data, structured analytical tools, digital solutions, and reproducible assessment protocols. Institutional flexibility, teacher professional training, and stakeholder engagement in shaping inclusive environments are recognized as priority conditions. The practices described in the literature aim to universalize approaches while maintaining sensitivity to cultural and organizational contexts. Thus, a foundation is being laid for evidence-based pedagogy that combines scalability, adaptability, and empirical verifiability.

Several reviews report the active use of mixed analysis methods (e.g., thematic coding combined with network analysis or factor modeling). This approach enables the identification of hidden patterns in the distribution of inclusive practices. Open international databases (such as OECD TALIS, PISA Inclusive Module) are frequently used, providing additional empirical reliability. It is also noted that a systemic approach to inclusion increasingly relies on evaluating the impact of educational interventions through meta-analyses and randomized studies. There is a growing trend toward developing unified indicators of inclusive education quality, which is important for policy-

Table 6. Thematic Distribution of Publications by Areas of Inclusive Education

ID	Research Aim	Target Group	Methodology	Sample Size	Country / Region	Key Findings	Challenges / Barriers	Practical Recommendations	Originality / Value
Theme 1: Inclusive Education and Pedagogical Support									
[9]	To examine the integration of social justice principles into Thailand's teacher education programs and assess the readiness of future educators for inclusive teaching.	Teacher education faculty and student teachers; marginalized groups (ethnic minorities, LGBTQ+).	Qualitative study; thematic analysis of interviews, focus groups, and documents.	15 faculty members, 25 students	Thailand	There is a gap between policy and practice; low level of practical preparedness for inclusion.	Insufficient support, lack of clear understanding of social justice, weak practical orientation.	Curriculum revision, development of professional training, community engagement projects.	First study of its kind in the Thai context; contributes to inclusive teacher education.
[39]	To explore teaching strategies used by teachers in inclusive education in rural primary schools in Indonesia and their perceptions of inclusion.	Primary school teachers (grades 2–6) working with children with special needs.	Qualitative study: classroom observations and short interviews.	40 teachers from 10 rural schools	Indonesia (rural areas)	Only a few teachers apply effective inclusive strategies such as differentiation and co-teaching.	Low teacher confidence, lack of knowledge, large class sizes.	Need for professional development programs and inclusive teaching competence.	First documentation of real strategies and barriers in rural Indonesian schools; focus on practical teacher preparation.
[40]	To study inclusive teaching practices in primary schools in Karnataka (India), focusing on teachers' perspectives and the context of national policy implementation.	Primary school teachers and students, especially children from vulnerable groups, including those with disabilities.	Fieldwork in five schools; analysis of classroom practices and teacher interviews.	5 schools from different districts	India, Karnataka	The state aims to implement inclusive education based on international frameworks, but there is a lack of localized understanding and practical implementation in schools.	Teachers lack conceptual understanding of inclusion and methodological tools for its implementation.	A coherent national strategy for inclusive education is needed, supported by teacher training and school- and state-level assistance.	Highlights the gap between international rhetoric and local practice; emphasizes the need for a systemic approach to teacher training and support for inclusion in daily teaching.
[41]	To examine how self-efficacy predicts teachers' attitudes toward inclusion controlling for gender, school locality, and teaching experience	Government elementary school teachers	Survey of 613 teachers; regression and ANOVA	613 teachers	India	Found a significant positive correlation between self-efficacy and teachers' attitudes	Self-efficacy had relatively modest predictive power when controlling for demographics	Focus on urban–rural differences and strengthening teachers' confidence in inclusion	Adds evidence from Indian context and examines moderating demographic variables

Table 6. (Continued)

ID	Research Aim	Target Group	Methodology	Sample Size	Country / Region	Key Findings	Challenges / Barriers	Practical Recommendations	Originality / Value
[42]	To test the psychometric validity of the Attitudes Towards Inclusion Scale (AIS) and the Intention to Teach in an Inclusive Classroom Scale (ITICS) in the Portuguese context.	Primary and secondary school teachers	Survey; factor analysis; internal consistency and validity analysis; AIS and ITICS scales.	171 teachers (86% female)	Portugal	The two-factor structure of the AIS (beliefs and feelings) and ITICS (curriculum change and consultation) scales was confirmed; teachers trained in inclusion showed more positive attitudes and intentions.	Lack of inclusion training reduces readiness and positivity among teachers.	Recommend adding new items to the ITICS scale and strengthening teacher training in inclusive education.	Contributes to the adaptation and improvement of psychometric tools for assessing attitudes toward inclusion in Portugal, with relevance for policy and education.
[11]	To examine teachers' perceptions of including children with disabilities in preschools and compare them with observed practices.	Educators in inclusive preschools	Mixed methods: questionnaire (closed and open questions) and observation using the Inclusive Classroom Profile (ICP)	35 educators	Not specified	Educators report high self-efficacy and a positive attitude toward inclusion, but express the need for additional training and support; observation data show that the level of inclusive practices ranges from minimal to good.	Insufficient teacher support and training in inclusive education.	Professional development programs and support are needed to improve the quality of inclusive practices.	The study combines self-assessment and external observation, providing a comprehensive picture of inclusion in preschools.
[43]	To justify the importance of the construct "classroom climate" for developing inclusive teaching in mainstream education.	Teachers and researchers	Theoretical literature review	Not specified	International	Classroom climate may act as a mediator between inclusive teaching and learning outcomes; it is linked to achievement, engagement, and well-being, including for students with special educational needs.	Difficulty of implementing inclusive teaching in mainstream classrooms; lack of monitoring and evaluation tools.	Use classroom climate factors and indicators as sensitive and practical tools for assessing and developing inclusive teaching.	Proposes a conceptual model in which classroom climate becomes a key tool for supporting and evaluating inclusive teaching in mainstream education.
[44]	To develop and evaluate an ICT tool aimed at preparing teachers for inclusive teaching of children with hearing impairments.	Teachers (12 participants)	User-Centered Design (UCD) methodology, CTT task structure, open development, usability testing using the SUS scale.	12 teachers	Not specified	The tool received a high usability rating (72.5 points on the SUS scale) and was positively perceived by teachers as a means of improving their preparedness for inclusive education.	Need for specialized training programs for teaching children with disabilities and developmental challenges.	Implementation of ICT tools and training teachers in their use in inclusive classrooms.	The use of open-source and user-centered design allowed the creation of an effective and accessible tool for teacher preparation.

Table 6. (Continued)

ID	Research Aim	Target Group	Methodology	Sample Size	Country / Region	Key Findings	Challenges / Barriers	Practical Recommendations	Originality / Value
[45]	To study the challenges, conditions, and strategies for implementing inclusive education in Ukraine.	304 educational professionals	Legal analysis of international and national regulations; survey of Inclusive Resource Center staff.	304 respondents	Ukraine	Ukraine has the prerequisites for developing inclusive education: legal, financial, organizational, staffing, and sanitary conditions have been established. Key directions for implementing inclusion across all education levels have been identified.	Informational, mental, institutional, and physical barriers to inclusion development.	Improve regulatory frameworks, develop multidisciplinary approaches, eliminate systemic barriers.	A comprehensive legal and sociological analysis of inclusive education in the Ukrainian context; emphasis on the strategic level.
[46]	To determine teachers' attitudes toward teaching students with mild learning disabilities (MLDs) in inclusive classrooms.	Primary school teachers in private inclusive and non-inclusive schools in Karachi.	Quantitative method, stratified sampling, structural modeling using Smart PLS 3.0.	230 teachers	Pakistan	Positive teacher attitudes toward students with MLD predict readiness for inclusive practice; however, a weak linear relationship was found between attitude and practical inclusion. Improving teachers' self-efficacy can significantly enhance their readiness through adequate resources and support.	Insufficient teacher training for working with children with MLD; weak link between beliefs and actions.	Increase teacher self-efficacy, provide targeted resources, train for work with MLD, offer school-level policy recommendations.	A comprehensive analysis of factors affecting the inclusion of students with mild learning disabilities, emphasizing the role of teacher self-efficacy in inclusive practices.
[47]	To examine how sustainable professional teacher communities promote the implementation of inclusive practices through teacher transformation.	Teachers participating in 10 professional communities.	Qualitative research; observation of teacher professional communities operating throughout the academic year.	156 educators	Not specified	Four stages of teacher transformation were identified: initial resistance to inclusion, realization of pedagogical misconceptions, development of nonjudgmental professional dialogue, and the formation of stable inclusive practices. Communities provide both emotional support and systematic development of professional competencies, fostering lasting changes in the educational environment.	Initial resistance to inclusion; pedagogical misconceptions.	Build sustainable professional communities as platforms for reflection, experience-sharing, and gradual acceptance of inclusion through collaborative learning.	A description of a sustainable model of professional development as a basis for systemic change in schools and the formation of inclusive educational practices.

Table 6. (Continued)

Theme 2: Spatial Organization of Inclusive Environments and Interior Design

ID	Research Aim	Target Group	Methodology	Sample Size	Country / Region	Key Findings	Challenges / Barriers	Practical Recommendations	Originality / Value
48	To identify and describe the benefits of inclusive classrooms for child development and socialization.	Children with special educational needs, parents, and teachers.	Analysis of academic publications on inclusive education; survey of teachers and parents of students in inclusive classrooms.	Not specified	Not specified	Inclusive education promotes development and successful socialization of children with special needs; it requires a suitable educational environment.	Need for new educational models; difficulties integrating into society.	Create inclusive environments, engage parents and teachers, consider children's individual needs.	Emphasizes the role of inclusive education in integrating children with disabilities into society.
16	To identify preferred relaxation methods among autistic adults and define the requirements for effective sensory rooms.	Adults with autism.	Online survey (AQ-50 + questionnaire with open/closed questions); qualitative content analysis.	N=150 (part 1), N=96 (part 2), N=13 (part 3)	English-speaking countries	Autistic adults use diverse sensory and behavioral relaxation strategies. Visual, auditory, and somatosensory modalities are key. Preferences vary, underscoring the need for personalization.	Limited availability of sensory rooms; low personalization; risk of misunderstanding needs.	Individualized design: adjustable lighting, sound, noise isolation, spaciousness.	Highlights the need for personalized sensory spaces. Offers a toolkit and design principles based on empirical data. First systematic classification of sensory relaxation categories in autistic adults.
15	To study the importance of inclusive school environment design for students with special educational needs.	Primary school children with disabilities.	Theoretical analysis of inclusive design and learning environment principles.	Not available	Not specified	Inclusive classrooms must consider the unique needs of all learners. Physical space (furniture, lighting, ventilation, colors, therapeutic elements) plays a vital role in supporting sensory, language, and emotional development in children with disabilities.	Lack of a universal design approach; difficulty adapting for sensory and cognitive differences.	Support for varied learning formats (pair, group, independent), use of sensory elements, adapted interiors.	Emphasizes physical space as a key factor in inclusive learning. Proposes a practical approach to designing environments tailored to multisensory perception and the needs of young learners with disabilities.

Table 6. (Continued)

ID	Research Aim	Target Group	Methodology	Sample Size	Country / Region	Key Findings	Challenges / Barriers	Practical Recommendations	Originality / Value
49	To present a clinical case of a child with autism and psychotic symptoms and search for effective therapy.	One child	Detailed case study: diagnosis, behavioral intervention, pharmacological treatment, educational program.	1	Not specified	A 5-year-old boy with ASD developed egodystonic hallucinations, speech regression, and reduced social interaction. ABA, medications, steroids, and immunotherapy were largely ineffective. A multidisciplinary center provided broad support including music, physical, and occupational therapy.	Challenges in differential diagnosis of psychosis in autistic children; limited treatment efficacy; behavioral and sensory difficulties.	Individualized approach: combining ABA, therapies, parental support, and multidisciplinary assessment; focus on safety, sensory regulation, and extended diagnostics.	Describes a rare combination of autism and early psychotic symptoms; emphasizes the need for comprehensive multidisciplinary support and family-centered intervention. Details on medical evaluation, therapies, and educational strategies are included.
50	To identify teaching practices that promote inclusive learning environments in higher education.	29 health and social service students	Appreciative Inquiry (AI), focused on identifying effective teaching practices.	29	Not specified	Identified 26 inclusive teaching practices and 5 resulting student outcomes. Based on Donabedian's model: structure (course/class setup), process (teacher–student interaction), and outcome (integration of both).	Alienation of BIPOC students; lower graduation rates compared to white students.	Implementation of recommended inclusive practices based on Donabedian's model to enhance student engagement and sense of belonging.	Provides an empirically validated set of inclusive teaching practices organized by structure/process/outcome model, enabling application across disciplines to support diverse student populations.
51	To develop a learning environment model using MOOCs to improve students' self-regulation.	3 experts in design/technology, 80 high school students	Design research: theoretical analysis, surveys, pilot experiment.	3 experts, 80 students (Khon Kaen Province)	Thailand	A 7-component learning environment model was developed: problem-based learning, resource room, self-regulation room, cognitive tools, collaboration, scaffolding, coaching.	Not explicitly stated; implies challenges in effective MOOC design and evaluation.	Implementation of the 7-component model to support autonomous learning and self-regulation skills.	Presents an integrated MOOC-based model for enhancing self-regulation, grounded in theory and empirically tested with high school students in Thailand.

Table 6. (Continued)

ID	Research Aim	Target Group	Methodology	Sample Size	Country / Region	Key Findings	Challenges / Barriers	Practical Recommendations	Originality / Value
8	To compare the effects of a VR sensory room and a physical sensory room on well-being and physiological indicators in psychiatric inpatients	Inpatients with bipolar disorder	Quasi-randomized study using self-assessment scales (VAS, MADRS-S, Beck Anxiety Scale, CGI); pre/post comparison	60 participants (40 – VR, 20 – physical room)	Sweden	Both VR and physical sensory rooms improve well-being and reduce physiological arousal. No statistically significant difference between the two. VR can serve as an alternative when a physical room is unavailable.	Limited sample power, potential inter-departmental condition differences	Use VR sensory rooms as an alternative in resource-limited settings; consider individual responses to sensory stimuli	First study to show comparable effectiveness of VR and physical sensory rooms in psychiatric settings; highlights potential of digital solutions in healthcare
17	To present the EDU-AI machine learning model for automatic classroom layout generation at early design stages	Classroom layouts	Two-stage ML model (GAN + Pix2Pix); trained on standard projects from Turkish Ministry of Education; validated on external plans; SSIM used for evaluation	Sample size not explicitly stated; standard and synthetic data used	Turkey	The model can generate classroom layouts with satisfactory accuracy even with limited data. Applicable at the early design stage and adaptable to various typologies.	Limited training dataset; need for adaptation to different countries and school types	Use EDU-AI during early design stages; retrain model for local conditions	First study proposing an ML tool (GAN + Pix2Pix) for zoning and furnishing classroom layouts; high applicability in educational architecture
21	To study the impact of emotionally inclusive classroom climate on adolescent well-being and identify key teacher competencies	Adolescents in secondary school	Systematic literature review in ERIC and WoS databases using PRISMA protocol; JBI Critical Appraisal Tools	32 studies (2016–2020)	Not specified	A positive association was found between emotionally inclusive classroom climate and adolescents' emotional well-being. Teachers play a critical role, and their training in emotional, interpersonal, and intercultural skills is essential.	Lack of adolescent-focused studies compared to primary education	Enhance teacher training in emotional and intercultural competencies; foster inclusive classroom climate	Provides a systematic overview of the importance of emotional climate in secondary education; highlights the undervalued role of teachers in adolescent support

Theme 3: Emotional and Social Development of Children in Inclusive Education

Table 6. (Continued)

ID	Research Aim	Target Group	Methodology	Sample Size	Country / Region	Key Findings	Challenges / Barriers	Practical Recommendations	Originality / Value
22	To describe a pilot virtual co-design session for jointly developing inclusive classroom norms	Engineering faculty and students	Virtual co-design session: teachers and students first discussed in separate groups, then together. Included surveys, idea artifacts, final norms, and observer reflections	Number not specified (noted as two stages: 20 and 40 min)	Not clearly stated	Sessions enabled the identification of exclusionary practices and proposals for inclusive norms. Revealed both explicit and implicit power dynamics between and within groups.	Power imbalances among participants; limited co-design experience	Structure co-design sessions with attention to power dynamics; ensure safe space for equal contribution	Valuable contribution to inclusive educational practices in engineering, emphasizing social interaction and power dynamics
52	To validate the PIQ (Perception of Inclusion Questionnaire) scale with a Swedish sample of students with and without SEN	5th and 8th grade students in inclusive schools	Used PIQ to measure emotional/social inclusion and academic self-concept	Exact number not provided	Sweden	Students with special educational needs (SEN) had lower emotional inclusion and academic self-concept. 8th-grade girls reported lower academic self-concept than younger girls and boys. However, girls with SEN had higher self-concept than boys with SEN.	Gender, age, and SEN status complicate result interpretation	Consider gender and age when assessing perceptions of inclusion and academic self-concept; adapt support strategies accordingly	Confirms PIQ applicability in Sweden; identifies previously unreported gender differences in this age group
53	To assess the impact of classroom inclusive norms on children's expectations and reasoning about including peers with learning difficulties	3rd–6th grade students (M = 10.2 years)	Multilevel analysis of children's responses to scenarios involving inclusion of peers with learning difficulties	1019 students	Switzerland	Children expected less inclusion from friends and fictional characters than from themselves. Inclusive norms positively influenced both personal and peer-expected behaviors. Stronger perception of norms reduced concerns about group success.	Individual differences in perceiving inclusive norms may hinder inclusion	Psychologists should strengthen students' perception of inclusive norms and consider individual differences	The study includes multiple perspectives (self, friends, and third-person characters), demonstrating the role of subjective norm perception in inclusion attitudes

Theme 4: Analytical Tools and Systematic Reviews of Inclusive Practices

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Table 6. (Continued)

ID	Research Aim	Target Group	Methodology	Sample Size	Country / Region	Key Findings	Challenges / Barriers	Practical Recommendations	Originality / Value
26	To conduct a systematic review of best inclusive teaching practices across countries	Not applicable (literature review)	Systematic literature review	Not specified	International	Five key categories identified: use of ICT, individualized learning, classroom management methods, collaboration, and curriculum adaptation	Implementing inclusion in diverse educational contexts is complex	Use technology, adapt curricula, individualize instruction, and apply flexible classroom management strategies	A comprehensive and structured global review of inclusive teaching practices, with clearly identified categories of effective approaches
28	To describe the development of an inclusive physical education teaching model for children with special educational needs	Children with special educational needs	Qualitative research, participatory action approach	Not specified	Colombia	The process included four stages: diagnosis, model design, implementation of teaching units, and evaluation. Emphasized the importance of shifting from integration to full inclusion.	Need for systemic change and active involvement of all participants	Use participatory approach; develop adapted programs involving both teachers and students	Practical case of inclusive PE teaching model creation in a specific school using a participatory methodology
27	To explore barriers to implementing inclusive education in Kazakhstan and other countries	System level	Comparative analysis of legislation and research	Not specified	Kazakhstan and others	A general commitment to inclusion was noted, yet subjective barriers persist globally: negative attitudes, lack of training and experience. Only a few countries have moved from policy to real practice.	Insufficient teacher training, subjective attitudes toward inclusion, lack of practical experience	Early and specialized teacher education in inclusive practices, including internships in relevant classrooms	Justifies the need for both mental and professional preparation of teachers as a key condition for effective inclusion implementation
29	To examine SOAR factors (Strengths, Opportunities, Aspirations, Results) promoting inclusive education	Teachers and administration of an inclusive school in Karachi	Qualitative study (semi-structured interviews, case study)	16 participants	Pakistan	The inclusive school demonstrates successful practices through emphasis on social connection, integration of daily activities in learning, and focus on the strengths of students with SEN. Teachers are motivated by the school's inclusive vision and adjust teaching methods accordingly.	Doubts among teachers and administrators about broad inclusion in mainstream schools	Create a supportive environment, foster social relationships, use real-life activities in teaching	A case of successful inclusive schooling in a developing country; uses the SOAR framework to analyze inclusive practices and teacher motivation

Table 6. (Continued)

ID	Research Aim	Target Group	Methodology	Sample Size	Country / Region	Key Findings	Challenges / Barriers	Practical Recommendations	Originality / Value
10	To identify and characterize inclusive teaching practices and classroom climate from students' perspectives	Undergraduate college students	Qualitative research (analysis of students' open-ended responses)	365 students	USA (public and private institutions)	Students emphasized the importance of a respectful, open, and welcoming atmosphere. Inclusive teaching positively affects all students, particularly those with disabilities and from ethnic minorities. Specific behaviors of teachers and peers that facilitate or hinder inclusion were identified.	Variations in perceptions of inclusion; inconsistent inclusive behavior by faculty and students	Develop skills in respectful communication, active listening, and support for diversity in the classroom	Elevates student voices as a data source; covers a range of university types; offers practical guidance for faculty on fostering an inclusive environment
30	To assess the implementation of a Pandemic Action Plan with a focus on telemedicine technologies	Medical institutions (hospitals)	Multi-phase project (3 stages), interviews with heads of 8 hospitals, structured expert group discussion	8 institutions	USA	Tools and strategies from the developed Action Plan helped overcome critical challenges during the COVID-19 pandemic. Implementation was most effective in organizations that had already integrated telemedicine into daily operations. Adoption of new technologies during a crisis proved difficult. Ongoing preparedness enhances healthcare resilience in emergencies.	Lack of preparedness for telemedicine use; challenges in urgent adoption of tools	Integrate telemedicine solutions and emergency response plans into daily institutional operations before crises occur	Empirical evaluation of a pandemic response plan; involvement of leading healthcare experts; interviews with 8 institutions that applied the plan

making at both the school and educational governance levels.

Discussion

The aim of this study was to analyze the directions and features of scientific publications related to inclusive education, with a focus on spatial environment design, pedagogical support, socio-emotional development, and systematic evaluation of practices. The results revealed a consistent trend toward expanding the scope of inclusion, incorporating interdisciplinary approaches, and strengthening the empirical grounding of conclusions.

The findings align with existing systematic and thematic reviews that emphasize the value of topic modeling algorithms for analyzing large text corpora in the humanities and education. For example, Jacobi et al. [34] demonstrated that the LDA method reliably identifies latent thematic structures and enables quantitative interpretation of content patterns in texts. Albalawi et al. [35] confirmed the applicability of LDA to the analysis of short texts such as abstracts and metadata of academic publications, which is particularly relevant for the present study. Unlike reviews focused mainly on theoretical models, this study is based on an empirical corpus of publications. It demonstrates how semantic links between terms reflect dominant research directions in the field of inclusion and educational environment design.

Moreover, the results obtained are consistent with the findings of the reviews by Mitchell [23] and Sharma et al. [24], which confirm the necessity of a systematic approach to inclusive education. However, unlike these works, the present study emphasizes the visualization of semantic connections between key concepts of inclusion. In the review by Black-Hawkins [25], the focus is placed on institutional indicators of inclusivity. Our approach is based on pairwise semantic analysis, which enables the identification of latent thematic interconnections.

Theme 1: Inclusive Education and Pedagogical Support

The topic of inclusive education remains one of the key priorities in contemporary educational science, especially in the context of shifting from the formal declaration of inclusion to its meaningful implementation in educational practice. Analysis of recent studies shows that successful inclusion is impossible without rethinking pedagogical strategies, transforming organizational culture, and developing the professional identity of educators [9, 11, 47].

Other studies emphasize the importance of differentiated and collaborative teaching, the use of ICT, and the creation of an inclusive classroom climate as key components of inclusive pedagogy [39, 43, 44]. At the same time, persistent barriers have been identified, including insufficient training of specialists, a low level of institutional support, pedagogical misconceptions, and a superficial understanding of the concept of inclusion itself [9, 11, 40].

Considerable attention is given to the transformation of teachers' professional thinking and the development of sustainable professional communities that facilitate experience sharing and the collective search for inclusive solutions [47]. Some studies demonstrate that a positive attitude toward inclusion is linked to self-efficacy and job satisfaction [41, 42, 46]. An important contribution to the field is the consideration of cultural and organizational context, which broadens the understanding of inclusion and enhances the applicability of research across different countries and educational systems [40, 43, 45].

Overall, the reviewed studies confirm that inclusion requires not only a regulatory framework but also a profound transformation of pedagogical practice. This aligns with the findings of the European Agency for Special Needs and Inclusive Education, which stresses the need to shift from a "services" model to a "participation" model in education, where the teacher plays a central role [11].

Comparison with other sources shows that in countries with a higher level of teacher training and a well-developed supportive educational environment, the level of acceptance and effectiveness of inclusion is significantly higher. For instance, as demonstrated in [39], the use of digital tools and co-teaching has a positive impact on the engagement of all students. In contrast, studies from countries with fragmented teacher training (e.g., [40]) reveal limited implementation, even when political support is present.

Interpretation of the data suggests that pedagogical support should be viewed as a systemic phenomenon. It must include not only training in inclusive teaching methods but also the development of an attitude of acceptance toward diversity. The latter requires a stable institutional culture. In this context, teachers' self-efficacy and professional well-being serve as mediators between educational policy and the quality of inclusive practice [41, 42].

Thus, despite the significant accumulation of data, there is still a lack of studies that consider the interaction of systemic factors, including institutional mechanisms, cultural context, and the resilience of professional communities. This highlights the need for future multifactorial research aimed at integrating pedagogical support into the broader context of educational reform.

Theme 2: Spatial Organization of Inclusive

Environments and Interior Design

The spatial organization of inclusive environments is emerging as a crucial direction in both research and design practice, as architectural and digital solutions have a direct impact on the quality of inclusive education. Studies on sensory adaptation of spaces highlight the importance of environmental factors for the emotional and cognitive comfort of learners. For example, the study by Jawad [15] thoroughly examines lighting, ventilation, and color design parameters that support sensory balance in children with disabilities. Similarly, the study by Mccabe et al. [16] emphasizes a personalized approach to designing sensory spaces for adults with autism spectrum disorders.

The development of digital solutions opens new horizons for shaping inclusive environments. According to the findings of Ilioudi et al. [8], virtual sensory rooms prove to be an effective alternative to physical spaces, especially in situations with limited access. A promising direction is the application of artificial intelligence [17], which enables the automatic generation of inclusive classroom layouts during the design phase, thereby simplifying the implementation of universal design principles.

However, the implementation of such solutions is accompanied by several challenges. Multiple publications [48, 49] emphasize the lack of universal standards as well as the insufficient consideration of cultural differences and individual needs in architectural designs. This underscores the need for an interdisciplinary approach involving collaboration among architects, educators, and sensory integration specialists.

The interpretation of the presented data suggests that the spatial environment should not be viewed merely as a physical shell but as an active participant in the educational process. In this context, space can either enhance or restrict inclusive opportunities. Research confirms that well-designed learning environments help reduce anxiety, improve attention, and foster positive interactions among learners, including those with disabilities [8, 15].

Comparative analysis with other studies shows that the most successful projects are implemented through close cooperation between architects and educators. This approach is supported by the findings of Mccabe et al. [16], who emphasize the need to develop universal educational spaces based on principles of multi-level sensory stimulation. Moreover, the results demonstrate that even minor architectural modifications, such as the introduction of "quiet zones" or tactile navigation, can significantly improve the accessibility of the educational environment.

Although architectural adaptation is recognized as an essential component of an inclusive setting, the pedagogical motivation behind spatial decisions requires further clarification. Specifically, the flexible organization of learning space creates conditions for differentiated instruction by supporting group work, pair activities, and individualized learning paces. As a result, spatial parameters function not just as environmental conditions but as an active tool for implementing inclusive pedagogical strategies.

The implications of these studies highlight the need to implement inclusive design standards as mandatory components of architectural evaluations for educational institutions. There is also a clear demand for the development of prototypes and pilot solutions that can be replicated. This approach is particularly relevant for regions with limited budgets or complex infrastructure. The use of digital technologies, including virtual and augmented reality, can serve as a valuable resource for modeling inclusive environments during the early design phase.

As a result, space in an inclusive school is no longer a neutral backdrop but becomes a tool for pedagogical and social interaction. However, the widespread adoption of such solutions requires systemic support, interdisciplinary collaboration, and consideration of cultural and behavioral diversity, which opens up a broad field for future research.

Theme 3: Emotional and Social Development of Students in Inclusive Education

Emotional and social development of students in inclusive educational settings is becoming the focus of an increasing number of empirical and theoretical studies. A close relationship has been confirmed between classroom climate and adolescents' emotional well-being. A systematic review by Iglesias-Diaz et al. [21] emphasizes the importance of preparing teachers to work within emotionally diverse and intercultural environments. The influence of inclusive norms on students' attitudes toward peers with special educational needs (SEN) was analyzed in the study by Barth and Gruetter [53]. The authors found that a positive perception of norms fosters greater willingness to cooperate and reduces concerns about the group's academic performance.

Gender and age differences in perceptions of inclusion were explored in the study by DeVries et al. [52], which identified variations in academic self-esteem between boys and girls, as well as between students with and without SEN. This highlights the need for individualized psychological and pedagogical support. At the same time, the study by Mejia et al. [22] demonstrates the potential of co-design as a tool for shaping inclusive norms. Collaborative efforts between students and educators help reveal underlying power dynamics and foster norms that ensure more equitable

interactions within the learning group.

The interpretation of the findings confirms that students' socio-emotional well-being in inclusive settings depends not only on being educated together but also on the quality of interpersonal interactions developed within the classroom. It is important to note that the emotional comfort of students with SEN is closely linked to their peers' attitudes and teachers' behavioral dispositions [21].

Comparison with other studies shows that a positive classroom climate, participation in joint projects, and inclusive communication ethics significantly increase students' empathy and reduce anxiety levels [53]. The gender differences revealed in self-esteem and perception of inclusiveness further emphasize the need for flexible forms of psychological support and interdisciplinary guidance, especially during adolescence [52].

These findings imply the necessity of targeted teacher training for managing emotional dynamics in inclusive classrooms. In this context, co-design can serve not only as a tool for spatial adaptation but also as a means of building shared values [22]. Such recommendations help make pedagogical practice more deliberate and resilient to conflict.

In summary, the topic of emotional and social development becomes central in the discussion of inclusive education quality. This area requires a comprehensive approach that integrates pedagogical, psychological, and cultural dimensions.

Theme 4: Analytical Tools and Systematic Reviews of Inclusive Practices

An analysis of the publications revealed a growing interest among researchers in developing a comprehensive understanding and evaluation of the effectiveness of inclusive education. Most studies are based on systemic approaches and international data, which allows researchers to identify both universal and context-specific features of inclusion implementation [26, 27]. Considerable attention is given to practical experiences, ranging from the development of teaching models involving children with special educational needs (SEN) to the adaptation of existing strategies that take into account cultural and organizational conditions [28, 29].

Professional development of teachers, the creation of a respectful and open atmosphere in educational settings, and the inclusion of student perspectives are seen as key conditions for establishing effective inclusive practices [10]. Furthermore, the studies emphasize the importance of the readiness of educational and social institutions to apply inclusive technologies not only under normal circumstances but also in crisis situations [30].

A unifying element across the reviewed research is the focus on evidence-based and reproducible

approaches to evaluating inclusion, as well as a commitment to translating educational policy into practical action.

The findings of the analysis on assessment tools and systematic reviews of inclusive practice indicate a growing trend toward a structured and international approach to inclusion research. Studies confirm that systemic analytics not only enable the identification of inclusion levels across different countries and institutions but also help to establish strategic benchmarks for educational policy [26, 27]. The interpretation suggests that the demand for systemic models arises from the need to consider a wide range of factors, from interpersonal interaction at the micro level to education policy at the macro level. At the same time, several publications emphasize that universal frameworks must be adapted to specific cultural and organizational contexts [28, 29].

Comparison with other approaches highlights the importance of involving students in assessment processes. This approach not only enhances the relevance of the results but also strengthens the agency of educational stakeholders. Moreover, the use of digital and telecommunication tools broadens the concept of inclusion as a flexible and adaptive system [30].

The implications point to the need for further integration of research findings into practice. Without effective mechanisms for translating research results into educational and administrative action, the principles of inclusion risk remaining merely declarative.

Geographical Diversification of the Analyzed Sources

In addition to the thematic analysis, an important outcome of the review was the identification of the geographical representation of the publications, which broadens the interpretation of inclusion-related themes by incorporating regional contexts. A key aspect of interpreting the identified thematic directions is the geographical coverage of the analyzed literature, which expands the framework of inclusive education analysis by accounting for intercultural and institutional diversity.

European experience is widely represented through studies from the United Kingdom (Florian & Beaton [3]; Imrie [12]), Austria (Schwab [18]), Netherlands (De Boer et al. [20]), Portugal (Laranjeira et al. [42]), and Greece (Ioannidi & Malafantis [1]). These publications focus on systemic pedagogical support, the role of teachers, and the development of emotional climate in educational settings.

Canada and Australia also play a significant role: Loreman [6] advances the concept of inclusive pedagogy, while Byers & Imms [14] and Lawrie et al. [4] emphasize the importance of physical space and architectural flexibility in implementing inclusive

strategies.

Countries with Transitional and Emerging Educational Systems

Publications from India (Ramchand [40]; Sharma et al. [24]), South Africa (Walton & Rusznyak [7]), Thailand (Nopas [9]), Indonesia (Kurniawati [39]), Kazakhstan (Maulsharif et al. [27]), Pakistan (Kamran et al. [29]), Ukraine (Udych et al. [45]), and Colombia (Cruz et al. [28]) represent countries with transitional and emerging educational systems. These studies highlight challenges related to resource limitations, insufficient teacher training, and sociocultural barriers to inclusion.

International and multinational reviews, such as those by Mitchell [23] and country-level syntheses (Lawrie et al. [4]), provide a broader analytical framework, enabling comparison of national strategies and identification of global patterns.

Thus, the geographical diversification of sources confirms both the universality of certain inclusion-related themes and the need to adapt inclusive approaches to specific national contexts. This foundation supports future comparative research and facilitates transnational exchange of effective educational practices.

Relevance of Identified Themes to Physical Education Practice

Although most of the analyzed publications focus on cognitive, social, and spatial inclusion, several solutions and methodological approaches are directly relevant to the field of physical education and sports pedagogy. For example, the study by Cruz et al. [28] proposed an inclusive physical education plan for younger students that emphasizes the importance of adaptive motor activities and flexible teaching. Kamran et al. [29] analyzed inclusive practices in a Pakistani school using the SOAR method and demonstrated that physical activity and its pedagogical organization play a key role in fostering a positive inclusive learning experience.

Moreover, many strategies discussed in other thematic sections, such as spatial transformation, sensory regulation, tutor support, and variability in instructional formats, are applicable in physical education contexts. In such settings, inclusion requires coordinated consideration of motor, social, and emotional components. Therefore, the findings and conceptual conclusions have strong potential for application in inclusive physical and sports education practice, particularly in the design of learning environments, organization of group activities, and provision of pedagogical support.

Summary of Findings Across Thematic Areas

While themes such as inclusive pedagogy, spatial design of learning environments, and social support have already attracted scholarly attention, the novelty of this study lies in its interdisciplinary integration of these aspects through semantic modeling. The thematic structuring of the literature corpus enabled the identification of hidden interconnections among architectural, pedagogical, and institutional components of inclusion, which have not been systematically addressed in previous reviews.

The identified thematic clusters not only confirm stable directions in inclusive practice but also help to establish practical guidelines for different target groups of professionals:
• For educators, key priorities include fostering an emotionally safe environment, applying differentiated approaches and digital tools, and participating in the formation of inclusive norms.
• For architects and designers, priorities involve applying universal design principles, ensuring sensory adaptability, organizing classrooms with flexibility, and accounting for cultural differences.
• For administrators, important tasks include institutionalizing inclusive support, integrating relevant competencies into professional standards, and ensuring interdisciplinary collaboration.

Therefore, the findings have clear practical applicability in both educational and architectural design contexts.

Furthermore it should be emphasized that systematic reviews and assessment tools are not only a reflection of the current state of inclusion but also serve as instruments for its sustainable development. This approach fosters evidence-based decision-making, enhances the accountability of educational institutions, and strengthens the connection between policy and practice. Their use makes it possible to identify weak points in the implementation of inclusive strategies and to suggest specific directions for improving educational approaches. Through systematic analysis, it becomes feasible to monitor change dynamics, assess program effectiveness, and build representative databases essential for comparative international studies. These tools also promote more active involvement of all stakeholders in the development and implementation of inclusive solutions. All of this highlights the need for continuous methodological updates and the advancement of multidisciplinary approaches in inclusion assessment.

The findings are not only of analytical value but also offer practical guidance for the advancement of pedagogical theory and educational policy. In particular, the thematic core related to architectural adaptation, emotional climate, and pedagogical support underscores the need to integrate institutional and spatial mechanisms in the design of teacher training programs. This confirms that inclusion cannot be treated solely as a pedagogical issue but requires alignment among educational policy, environmental design, and teacher preparation.

Therefore, the results of this review can serve

as a foundation for recommendations to reform pedagogical standards, in which an interdisciplinary model of teacher training for inclusive classrooms should be embedded.

Limitations of the Study

The conducted study has several limitations that should be considered when interpreting the findings. First, the analysis included only publications in English, which may have led to the exclusion of important studies published in other languages. This is especially relevant for research from countries with developing inclusive education systems. Second, the timeframe was limited to a five-year period. While this made it possible to reflect current trends, it excluded earlier foundational studies that contributed to the development of inclusion theory. Additionally, the data source was limited to the Web of Science database, which narrows the overall coverage. It is likely that a number of relevant studies are indexed in other academic databases and registries.

One of the methodological limitations of this review is the use of LDA modeling, in which the initial iteration resulted in a topic coherence score of less than 0.5. Although further calibration of the model, including adjustments to the number of topics and improvements to dictionary filtering, enhanced the interpretability of the topics, the initially low coherence score may indicate partial thematic overlap or insufficient topic separation [33, 34, 35]. Such parameters are typical for texts in the humanities, which often contain high thematic interconnection and complex terminology. Nevertheless, the interpretation results were manually verified and aligned with the context of inclusive education, which improved their substantive validity.

Additional methodological limitations include the dependency on the quality of source metadata in the Web of Science database, the possibility of semantic distortions during automated text processing, and the restricted scope of English-language publications. Despite the high coherence of the topic models, their interpretation requires consideration of cultural and contextual differences.

A separate limitation is the focus on school education. The analysis did not include publications related to inclusion in the field of adult education. This leaves out important aspects of lifelong learning and social adaptation. In addition, some architectural and design solutions aimed at creating a comfortable and supportive learning environment in institutions with unique cultural and regional characteristics were not considered. These limitations indicate directions for future, broader research.

Conclusions

The present study made it possible to systematize the key directions of scholarly reflection in the field of inclusive education based on thematic modeling of publications.

Theme 1. Inclusive education and pedagogical support. The importance of creating an emotionally supportive environment, developing teachers' professional competencies, and using digital tools in inclusive settings was confirmed.

Theme 2. Spatial organization of the inclusive environment. Spatial solutions play an active role in supporting inclusive scenarios. The need for flexible, multisensory, and personalized architecture of educational spaces was highlighted.

Theme 3. Emotional and social development. The role of a positive social climate, emotional engagement, and student participation in shaping inclusive norms was emphasized as factors of sustainable integration.

Theme 4. Systematic assessment and analytical tools. An increase in the use of digital and evidence-based methods aimed at standardizing and ensuring the reproducibility of inclusive practice evaluation was noted.

The systematic review identified areas where further research can contribute to a deeper understanding and practical implementation of inclusive education. This includes the evaluation of the effectiveness of applied strategies, adaptation of solutions to diverse contexts, and the development of new tools for monitoring and supporting inclusive practices.

Conflict of Interest

One of the authors (Wladyslaw Jagiello) serves as the Deputy Editor and publisher of this journal. Another author (Tetiana Yermakova) is a member of the editorial board. To ensure objectivity in the review process, the manuscript was assessed by an independent editorial board member and reviewed by external reviewers who have no association with the authors. The Deputy Editor and the editorial board member did not participate in the peer review or editorial decision-making regarding this manuscript. The other co-authors (Iryna Bondarenko, Vladyslav Kutateladze) declare no conflict of interest related to this publication.

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