Implementing Deep Learning Approaches for Students with Special Needs: A Systematic Literature Review

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Abstract: The purpose, this systematic literature review (SLR) is to explore how deep learning approaches have been implemented to support students with special educational needs (SEN). Method, following the PRISMA 2020 protocol, a comprehensive search was conducted across major academic databases including Scopus, Web of Science, and ERIC. The selection process resulted in 56 peer-reviewed articles published between 2015 and 2025 that met the inclusion criteria. The data were analysed thematically to identify implementation strategies, common practices, benefits, challenges, and contextual factors influencing deep learning in inclusive classrooms. The review reveals that deep learning in inclusive education for students with SEN primarily involves strategies such as project-based learning, collaborative inquiry, and metacognitive scaffolding. Teachers play a pivotal role in facilitating deep learning through adaptive instruction and emotional support. However, challenges such as limited teacher training, rigid curricula, and inadequate school support systems persist. Studies also highlight the significance of school culture and curriculum flexibility in sustaining deep learning practices. Despite positive impacts on student engagement, critical thinking, and social-emotional growth, the integration of deep learning remains uneven across contexts. Conclusion: Deep learning holds promising potential for enhancing educational experiences and outcomes for students with special needs in inclusive settings. However, successful implementation requires systemic alignment between teacher competencies, curriculum design, and institutional support.

1 INTRODUCTION

The transformation of 21st-century education emphasises learning that focuses not only on academic achievement but also on developing higher-order thinking skills, creativity, collaboration, and problem-solving. The deep learning approach responds to this need, emphasising conceptual understanding, critical reflection, the interconnectedness of concepts, and the application of knowledge in real-world contexts (Zebua, 2025). In practice, deep learning positions students as active learners who construct knowledge through meaningful experiences, rather than simply memorising information (MacFarlane et al., 2017).

In Indonesia, the direction of educational policy that upholds similar values is reflected in the Independent Curriculum. This curriculum emphasises differentiated, project-based learning and focuses on strengthening competencies and character (Marlina, 2019). Students are encouraged to have agency (control over their learning process), and teachers act as facilitators, adapting approaches to individual learners' needs. This is particularly relevant for students with special needs, who require a flexible, meaningful learning approach that is oriented toward their unique potential (Jauhari & Idhartono, 2022).

Both deep learning and the Independent Curriculum share a common thread in promoting

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transformative, participatory, and student-centered learning. However, to date, few studies have specifically evaluated how deep learning principles are implemented in the context of special education in Indonesia, particularly within the framework of the Independent Curriculum. Empirical evidence remains limited regarding the effectiveness of deep learning strategies in improving engagement, conceptual understanding, and the social-emotional development of students with special needs, both in inclusive and special schools (Andayanie, et al, 2025).

One approach that is increasingly being studied in 21st-century education is deep learning. Unlike surface learning, which focuses solely on memorization and repetition of information, deep learning encourages students to think critically, solve problems, understand the meaning of concepts, and connect new information to existing knowledge. This approach is capable of improving the quality of the teaching and learning process. It is relevant to the demands of 21st-century competencies such as collaboration, communication, creativity, and critical thinking (Thornhill-Miller et al., 2023).

In the context of students with special needs studying in inclusive schools, implementing immersive learning presents unique challenges. Their limitations in cognitive, social, and adaptive abilities require teachers to adapt learning strategies to ensure they remain meaningful and accessible to all students (Darwish et al., 2025). Meanwhile, literature that discusses the practical implementation of immersive learning for students with special needs in inclusive classrooms remains limited and scattered.

Therefore, this study aims to conduct a Systematic Literature Review (SLR) to collect, analyse, and synthesise relevant research findings related to the implementation of immersive learning for students with special needs in inclusive schools. This study uses the PRISMA 2020 guidelines for literature identification and analysis, as well as the PICo framework for determining the focus population, interventions, and context. The results of this systematic review are expected to provide a more comprehensive understanding, identify good practices, and uncover challenges and recommendations in implementing inclusive and adaptive immersive learning for students with special needs. In this systematic review, the research questions formulated are as follows:

1. How is deep learning implemented in inclusive schools to support students with special educational needs (SEN)?
2. What types of deep learning strategies are most commonly used for students with special educational needs (SEN)?
3. What benefits and challenges are reported in the implementation of deep learning approaches for SEN students?
4. What contextual factors (e.g., teacher roles, curriculum design, school environment) influence the success of deep learning implementation in inclusive classrooms?
5. To what extent do existing studies integrate inclusive principles into deep learning practices for students with special needs?

2 METHOD

2.1 Research Design and Data Sources

This study uses a systematic literature review approach to examine the implementation of deep learning in education for students with special needs. The goal is to systematically identify, evaluate, and synthesise relevant literature to obtain a comprehensive overview of the practices, challenges, and effectiveness of its implementation. The review process follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines developed by Page et al. (2021) to ensure transparency, objectivity, and rigour in literature selection. The PRISMA approach includes three main stages: identification, screening (including eligibility assessment), and inclusion. Each stage is carefully conducted to ensure that the analysed sources are valid, relevant, and contribute to the development of deep learning strategies that are appropriate to the needs of students with special needs. This process flow is depicted in the PRISMA diagram in Figure 1.

2.2 Databases

A literature search was conducted using the academic database Scopus.com, as it aggregates articles from various scientific journals, offering broad and diverse coverage. This database selection ensured access to multidisciplinary research, allowing for a comprehensive overview of the topics explored in this study. This timeframe ensured the inclusion of the most recent and relevant studies.

A structured literature search was conducted using the Scopus.com database, using targeted search terms. A series of structured search terms was used to capture a comprehensive range of studies related to immersive learning in Special Education, including

forms, types, benefits, challenges, and factors influencing the implementation of immersive learning for students with special needs.
The search queries included:

1. ["Deep Learning"] OR ["Immersive Learning]
2. ["Students with Intelectual disabilities"] OR ["Mentally Retarded"]
3. ["Meaningful Learning"] OR ["Joyful Learning"] OR ["Mindful Learning"].

2.3 Inclusion and Exclusion Criteria Data

This study establishes inclusion and exclusion criteria to ensure that the study conducted is relevant and academically credible. Exclusion criteria include: (1) Document type: book, book chapter, conference paper, conference review, (2) Language: other than English, (3) Publication year: other than 2015-July 2025. At the same time, inclusion criteria include: (1) Document type: article, (2) Language: written in English, (3) Source type: only articles, (4) Article publication year from 2015 to 2025.

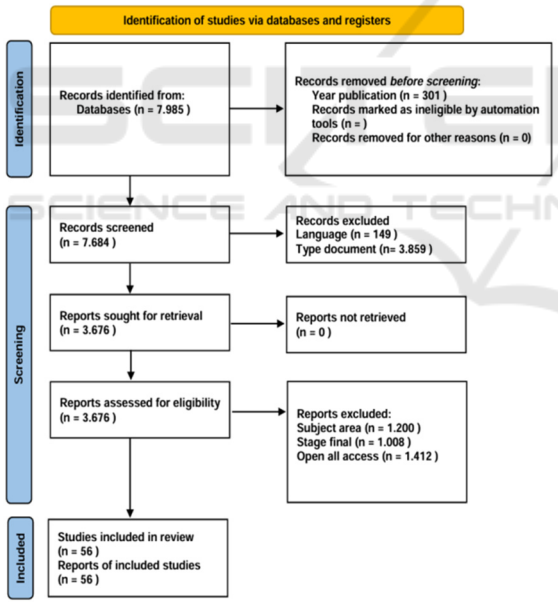

Figure 1: PRISMA Flowchart.

2.4 Data Extraction

Information collected from each article: (1) author name and year, (2) country of origin of the study, (3) research objectives, (4) participant characteristics (age, stage, diagnosis), (5) methodology, (6) deep learning strategy used, and (7) main findings.

2.5 Documents Included in the Analysis

After screening and eligibility, 56 documents meeting the inclusion criteria were selected for further analysis. Figure 1 shows the selection process. The datasets were combined into CSV files for bibliometric analysis using Rstudio and Bibliometrics. This approach combines empirical and systematic literature, providing information on the implementation of immersive learning for students with special needs.

2.6 Quality and Credibility

Data collection in this study was conducted rigorously to ensure only high-quality articles were analyzed. Each metadata entry was carefully reviewed to ensure the accuracy and completeness of information, including title, author(s), year of publication, keywords, and number of citations. This verification process ensures the validity and reliability of the bibliometric analysis results. Table 1 shows that most metadata elements, such as abstract, author(s), DOI, document type, journal, language, year of publication, title, total citations, references, affiliations, keywords, corresponding author(s), additional keywords, and scientific category, were fully available. This completeness provides a strong foundation for bibliometric analysis, as it allows for accurate mapping of citations and the influence of authors or journals. However, deficiencies in some metadata elements can still impact the overall completeness of the analysis results.

The keyword data completion rate (DE) was only 8.93% and publication year (PY) data was recorded at 0%, indicating data gaps, albeit minimal. The absence of keyword data can reduce the accuracy of thematic and co-occurrence analyses, which are crucial for identifying research trends. Meanwhile, the completeness of corresponding author (RP) data was only 7.14%, potentially limiting the analysis of inter-researcher collaboration networks and mapping institutional relationships in deep learning implementation studies.

In contrast, several metadata elements exhibit significant deficiencies, such as keywords plus (ID) with 39.29% missing data, cited references (CR) with 1.79% missing data, and science categories (WC) with 100% missing data. These deficiencies are critical because they significantly limit citation network analysis and thematic exploration, thus hindering the identification of key themes and broader scientific relationships within the literature. The absence of data on ID and WC particularly

reduces the ability to map interrelated concepts and research dynamics in this field.

Table 1: Completeness of Deep Learning Bibliographic Metadata.

Metadata	Description	Missing Counts	Missing %	Status
AB	Abstract	0	0.00	Excellent
C1	Affiliation	0	0.00	Excellent
AU	Author	0	0.00	Excellent
DI	DOI	0	0.00	Excellent
DT	Document Type	0	0.00	Excellent
SO	Journal	0	0.00	Excellent
LA	Language	0	0.00	Excellent
PY	Publication Year	0	0.00	Excellent
TI	Title	0	0.00	Excellent
TC	Total Citation	0	0.00	Excellent
CR	Cited References	1	1.79	Good
RP	Corresponding Author	4	7.14	Good
DE	Keywords	5	8.93	Good
ID	Keywords Plus	22	39.29	Poor
WC	Science Categories	56	100.00	Completely missing

Although some metadata elements, such as keywords plus (ID) and scientific categories (WC), experienced data loss, this deficiency could be addressed by utilizing the author keywords (DE) available in the metadata. Co-occurrence analysis could still be conducted with limited scope to map key themes in research on implementing deep learning for students with special needs. In the context of this research, mapping trends, citation patterns, and researcher collaborations was crucial. Therefore, while the absence of WC and ID limited certain aspects of the analysis, the availability of other metadata still allowed the research to proceed without compromising the integrity of the analysis (Aria & Cuccurullo, 2017)

2.7 Data Analysis

Data were analyzed using thematic analysis with a narrative synthesis approach. This was because the data obtained from the included studies were qualitative and quantitative descriptive, demonstrating diversity in methodology, context, and forms of in-depth learning interventions for students with special needs.

3 RESULT

3.1 Demographic Distribution Results

This study analyzed 56 articles on the implementation of immersive learning for students with special needs published between 2015 and 2025. The publication growth rate reached 7.18% annually, reflecting the increasing attention to this topic. A total of 225 authors were involved, with two articles written individually. Each article had an average of four authors, indicating a strong collaborative nature. International collaboration was reflected in 28.57% of articles involving authors from different countries.

Keyword analysis identified 211 unique terms, indicating broad thematic and conceptual diversity. The average age of the documents was 3.27 years, indicating the novelty of the reviewed literature. An average of 26.05 citations per article indicates significant academic impact. Figure 2 visually presents demographic data and publication characteristics.

Figure 2: Demographic Distribution Results of Deep Learning Data.

3.2 Annual Publication Trends

Figure 3 shows a slow growth in publications related to the implementation of deep learning for students with special needs from 2015-2025, with each article published. In 2015-2017, there was an increase in publications of 3 articles, and in 2018, there was a decrease in publications of 0 articles. In 2019-2021, there was an increase in publications of 21 articles. In 2022, there was a decrease in publications of 8 articles. In 2023, there was an increase in publications of 13 articles. In 2024-2025, there was a decreased in publications of 11 articles.

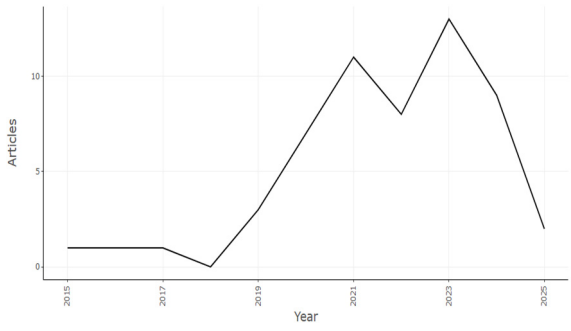

Figure 3: Annual Publication Trends in Deep Learning.

3.3 Country Level Analysis

The USA leads research publications on implementing immersive learning for students with special needs, with 26 papers published between 2015-2025.

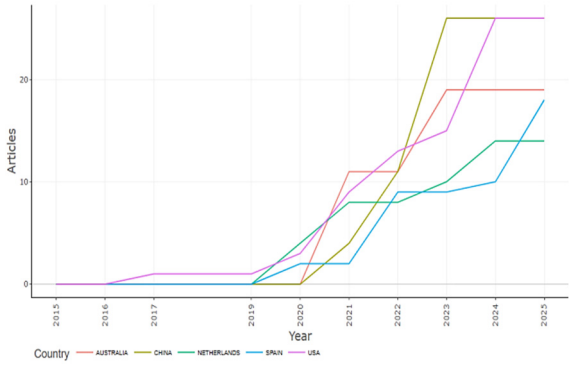

Figure 4: Country-Level Analysis of Deep Learning.

Figure 4 provides information on the number of citations and average citations of articles by country. The USA published 95 articles. Other countries, such as China, published 41 articles, Australia published 60, Spain published 50, and the Netherlands published 58.

Table 2: Most Cited Countries.

Country	TC	Average Article Citation
NETHERLANDS	258	64.50
SWEDEN	232	232.00
UNITED KINGDOM	203	101.50
USA	106	17.70
CHINA	96	16.00
ITALY	77	38.50
AUSTRIA	51	51.00
KOREA	47	15.70
AUSTRALIA	44	14.70
INDIA	41	41.00

3.4 Key Contributors and Influential Institutions

3.4.1 Most Relevant Authors

This study identified several academics who consistently published articles on immersive learning and students with special needs between 2015 and 2025. Table 3 presents the 10 most relevant authors and their number of publications. The most prominent authors on this topic are Alkhurayyif, Yazeed.

Table 3: Most Relevant Authors in the Research.

Authors	Articles	Articles Fractionalized
AKGÜL, YAKUP	1	0.50
ALKHURAYYIF, YAZEED	1	0.50
FORMOSA, NICOLETTE	1	0.20
GHADAMI, AMIRHOSSEIN	1	0.50
GEORGIOU, THEODOROS	1	0.25
GU, WEIWEI	1	0.25
HUBER, FLORIAN	1	0.25
KIM, HAE-RAN	1	0.25
QI, WENWEN	1	1.00
RUGGERI, FEDERICO	1	0.25

3.4.2 Author Productivity

Most authors (99.6%) published only one article, while only 0.4% contributed more than one publication related to implementing deep learning for students with special needs.

Table 4: Author Productivity.

Documents Written	N. of Authors	Proportion of Authors	Theoretical
1	224	0.996	0.800
2	1	0.004	0.200

3.4.3 Author Impact: h-index, g-index, and m-index

In addition to assessing the number of publications, researchers evaluated the impact of each author's h-index, g-index, and m-index. These indices help measure an author's contributions' overall quality and impact. Table 2 shows that the authors' h-index averaged 1.

Tabel 5: Impact of Author Indexing.

Author	h_index	g_index	m_index	TC	NP	PY_Start
Akgül, Yakup	1	1	0.250	29	1	2022
Alkhurayyif, Yazeed	1	1	0.333	4	1	2023
Formosa, Nicolette	1	1	0.167	168	1	2020
Ghadami, Amirhossein	1	1	0.500	1	1	2024
Georgiou, Theodoros	1	1	0.167	1	1	2020
Gu, Weiwei	1	1	0.200	32	1	2021
Huber, Florian	1	1	0.200	95	1	2021
Kim, Hae-Ran	1	1	0.250	11	1	2022
Qi, Wenwen	1	1	0.250	25	1	2022
Ruggeri, Federico	1	1	0.250	20	1	2022

3.4.4 The Most Influential Institutions

Some affiliates that emerged as the main actors in the research on the implementation of in-depth learning for students with special needs from 2015 to 2025, the data shows that Universidad De Deusto, with eight articles, as depicted in Table 6.

Table 6: Most Relevant Affiliates.

Affiliation	Articles
Universidad De Deusto	8
China University Of Geosciences	7
Monash University	7
University Of Melbourne	6
City University Of New York	5
Discovery Sciences	5
Ewha Womans University	5
Universitat Pompeu Fabra	5
University Of New South Wales	5
China Three Gorges University	4

4 DISCUSSION

4.1 Deep Learning in an Inclusive Context

Deep learning is an instructional approach that encourages students to think critically through analyzing, synthesizing, and evaluating information, rather than simply memorizing it. In inclusive education, this approach is tailored to meet the needs of students with intellectual disabilities, specific learning disabilities, and communication and social disabilities. This approach aligns with Universal Design for Learning (UDL) principles, which emphasize diversity in representation, expression, and engagement in learning (CAST, 2018).

Most studies indicate that deep learning is implemented through project-based learning, problem-based learning, and collaborative activities. These strategies are designed to engage students in meaningful activities that connect knowledge to real-world experiences. Some of the methods identified include:

a. Scaffolded inquiry with visual and concrete supports.
b. Story-based learning to enhance understanding of abstract concepts.
c. Peer tutoring and cooperative learning that encourage social interaction.

4.2 Deep Learning Implementation Strategies for Students with Special Needs

a. Project-Based Learning (PjBL) *and* Problem-Based Learning (PBL)
   This strategy is widely adopted because it facilitates collaboration, problem-solving, and reflection, which are the core of deep learning. For example, students with special needs are encouraged to complete real-life projects with visual support, scaffolding, and adaptive technology (Schuelka et al., 2019); (Prystiananta & Noviyanti, 2025). A study (Fernández-Batanero et al., 2022) showed that multimedia-based PjBL is effective in developing critical thinking skills in students with learning disabilities.
b. Adaptive Learning Technology
   This technology automatically detects student needs and adapts learning content in real time. Students with special needs can access audio, visual, or interactive materials. The AI system can adjust the difficulty level based on student responses, including for those with mild intellectual disabilities (Togni, 2025).
c. Collaborative Peer Mentoring and Guided Discussions
   Collaborative activities allow students with special needs to interact with peers through guidance and structured discussions, with the support of teachers as facilitators (Marlina et al., 2023). Dialogic learning in deep learning is crucial, especially for students with communication barriers (Luckin & Holmes, 2016).
d. The Role of Teachers and Inclusive Learning Design
   Successful implementation depends heavily on teachers' ability to design adaptive and reflective learning. Teachers need to use ongoing formative assessment, design reflective activities, and provide meaningful feedback. An inclusive approach based on deep learning requires detailed instructional planning and teacher training in reflective and collaborative learning strategies (Mitchell & Sutherland, 2020).

Table 7: Summary of Deep Learning Strategies.

No	Deep Learning Strategy	Example Activities	Supporting Studies
1	Project- Based Learning (PjBL)	Creating campaign posters, illustrated stories	Tan & Lim, Zahra et al.
2	Problem- Based Learning (PBL)	Solving school cleanliness issues	Lee & Kim, Yusuf et al.
3	Cooperative Learning & Peer Tutoring	Pair discussions, group games	Miller & Saunders, Rahman
4	Inquiry- Based Learning (IBL)	Plant/animal observations, basic science experiments	Garcia & Lopez, Tan & Lim
5	Teknologi Pendukung Deep Learning	AR/VR, educational apps, interactive media	Chen et al., Garcia & Lopez

4.3 Benefits and Challenges of Implementing a Deep Learning Approach for Students with Special Needs

Deep learning encourages students to go beyond memorizing information to understanding, connecting, and applying knowledge. In students with special needs, this approach has been shown to improve their ability to solve simple problems, understand cause-and-effect relationships, and

communicate thoughts verbally or visually. Project-based approaches have been shown to strengthen memory and conceptual connections (Nguyen & Nguyen, 2021; Lee & Kim, 2019).

Through project-based and cooperative learning methods, students actively engage with their peers, developing social and collaborative skills. Reported social benefits include increased empathy and tolerance from classmates and a sense of belonging for students with disabilities, who feel valued through their roles within the group (CAST, 2018). Furthermore, several studies have shown that deep learning encourages students to express themselves through portfolios, journals, or group discussions, which builds self-awareness and responsibility for the learning process (Lim & Tan, 2021).

Despite its benefits, implementing deep learning in the context of students with special needs is not without challenges. Four main challenges reported are: (1) limited teacher capacity, (2) minimal curriculum and policy support, (3) limited resources and technology, and (4) unequal participation in group activities.

Many teachers have not received adequate training in implementing deep learning strategies, particularly in differentiating learning for students with special needs (Marlina, 2021). Teachers often struggle to design assignments that are appropriate to students' cognitive levels and face increased workloads when preparing adapted materials. As many as 68% of teachers feel a lack of confidence in implementing project-based learning for students with special needs (Yusuf et al., 2022). In developing countries, including Indonesia, the national curriculum does not fully support the flexibility needed to implement deep learning in inclusive classrooms. As a result, teachers focus more on achieving formal academic targets than on developing deep thinking processes. Furthermore, there is no evaluation system that assesses higher-order thinking skills in students with disabilities. In practice, teachers often adapt deep learning strategies informally without the support of clear curriculum guidelines (Lee & Kim, 2019).

Implementing deep learning relies heavily on media, visual aids, technology, and sufficient time. Many inclusive schools face limitations: (1) access to interactive digital devices, (2) appropriate visual teaching materials, and (3) high teacher-student ratios (García-Robles et al., 2024). Despite collaborative efforts, some students with special needs are excluded from group discussions, especially with no clear roles. The impact is increased reliance on peers and shallow participation without cognitive engagement (Rahman et al., 2023).

4.4 Factors Influencing the Success of Deep Learning Implementation for Students with Special Needs

The successful implementation of a deep learning approach in inclusive classrooms for students with special needs is influenced by various factors, including teacher competency and perception, curriculum design and differentiation, a supportive inclusive learning environment, and the availability of resources and technology (Marlina, 2015). Studies show that success is highly dependent on teachers' abilities to: (1) design structured and adapted deep learning, (2) use approaches such as project-based learning, problem-based learning, and cooperative learning, and (3) manage heterogeneous classes based on needs. Teachers who have received training in inclusive pedagogy and higher-order thinking strategies are more successful in effectively implementing the deep learning approach (Yusuf et al., 2022). Teachers who have positive beliefs about the abilities of students with special needs are more likely to provide challenging yet accessible learning experiences (Lee & Kim, 2019).

Flexible modification of learning objectives, materials, and methods encourages the implementation of deep learning strategies. Good practices found include the use of UDL and the adoption of multi-tiered instruction based on student abilities. Multi-level planning within a single learning theme is crucial. Implementing deep learning relies on teachers' ability to differentiate content, processes, and products according to student profiles (Liang et al., 2024). Critical thinking task designs should be developed in multiple difficulty levels to ensure all students are meaningfully engaged (CAST, 2018). Schools that instill values of diversity, respect for differences, and encourage collaboration among students be more effective in implementing deep learning strategies (Lim & Tan, 2021). Support from school leaders and a collaborative work culture among teachers directly impact pedagogical innovation in inclusive classrooms, enabling positive interactions between students to become a catalyst for the active participation of students with special needs in complex tasks (Rahman et al., 2023). Access to visual aids, interactive technologies (such as AR/VR), and image-based learning materials significantly impact student engagement in deep learning. The use of VR-based simulations improves the understanding of abstract concepts (such as

gravity and weather) for students with special needs (García-Robles et al., 2024); (Tsai et al., 2020).

Table 8: Factors Determining the Success of Deep Learning.

Key Dimensions	Important Sub-Factors	Supporting Studies
Teacher Competencies	Pedagogical capacity, attitudes toward students	Yusuf et al. (2022); Lee & Kim (2019)
Curriculum Design	Curriculum flexibility, differentiation	CAST (2018); Nguyen et al. (2021)
Inclusive Environment	School culture, peer support	Tan & Lim (2021); Rahman et al. (2023)
Resources and Technology	Learning media, tools, teacher-student ratio	Garcia & Lopez (2023); Chen et al. (2020)

4.5 To What Extent Do Existing Studies Address the Role of Teachers, Curriculum, and School Environment in Facilitating Deep Learning for Students with Special Educational Needs?

The main findings indicate that most studies explicitly or implicitly acknowledge that the success of deep learning implementation is heavily influenced by three components of the education system: teachers as the primary facilitators, the curriculum as the pedagogical framework, and the school environment as the context for its implementation. However, the depth and focus of discussion on these three aspects vary across studies.

1. The Role of Teachers as Deep Learning Facilitators
   Teachers are the primary actors in deep learning strategies for students with special needs. Adaptations are made through project-based assignment modifications, visuals and concrete tools, group-based learning, and peer tutoring (Marlina, 2014). Creative teachers can transform problem-based learning into concrete and collaborative experiences for students with special needs (Lee & Kim, 2019); (Nguyen & Nguyen, 2021).
   The teacher's role as a scaffolding provider is crucial in helping students think reflectively, make connections, and develop deep understanding. Teachers' use of open-ended questions, step-by-step reflection, and verbal feedback can enhance students with special needs' ability to explore ideas (Lee & Kim, 2019). Studies also note that the success of deep learning is closely related to teachers' beliefs in the learning potential of students with special needs (Yusuf et al., 2022).
2. The Role of the Curriculum as a Driving Framework
   A curriculum implementing the UDL approach allows for various forms of representation and expression of learning (Lim & Tan, 2021); an open thematic curriculum provides space for teachers to develop collaborative and reflective learning (Zahra et al., n.d.). Conversely, several studies highlight that the national curriculum's overly academic and linear nature makes it difficult to implement deep learning, especially in inclusive classrooms. The absence of specific indicators for critical thinking or reflection skills in the curriculum makes deep learning a low priority (Tsai et al., 2020).
3. The Role of the School Environment in Supporting Deep Learning
   Schools that embrace a collaborative culture, value diversity, and allow for pedagogical innovation can provide a learning environment conducive to deep thinking. School environments open to innovative technologies (e.g., VR and interactive simulations) enable implementing more inclusive deep learning strategies (García-Robles et al., 2024). Principals and other educational leaders also significantly encourage innovation, training, and resources (Rahman et al., 2023)

5 CONCLUSION

An analysis of 56 articles shows that deep learning approaches significantly positively impact students with special needs, particularly in improving cognitive engagement, social interaction, contextual understanding, and higher-order thinking skills. The most commonly used strategies include project-based learning (PjBL), problem-based learning (PBL), cooperative learning, peer tutoring, and multimedia and AR/VR technologies. These approaches effectively bridge cognitive limitations through concrete, collaborative, and real-life learning experiences.

The success of implementation is heavily influenced by four main factors: (1) teacher competency and perception in designing in-depth learning, (2) curriculum flexibility that supports differentiation, (3) an inclusive learning environment that encourages collaboration, and (4) the availability of appropriate resources and technology. Despite the strong benefits, challenges remain, such as limited teacher training, an unadaptive curriculum, and limited access to technology.

Overall, the analyzed studies underscore the importance of integrating deep learning into inclusive education, supported by teacher training, an inclusive curriculum, and collaborative learning environments. Systemic efforts are needed to improve teacher

capacity, expand access to technology, and promote flexible education policies to enable students with intellectual disabilities to experience meaningful and immersive learning.

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