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RESEARCH ARTICLE

ASSESSING IMPACT OF UNIVERSAL DESIGN FOR LEARNING BASED INTERVENTIONS ON READING COMPETENCIES OF STUDENTS WITH INTELLECTUAL DISABILITIES

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Abstract

Reading difficulties continue to hinder academic participation and inclusive learning among students with intellectual disabilities, necessit ating flexible and accessible instructional approaches. This review critically examines the effectiveness of Universal Design for Learning (UDL)– based interventions in enhancing reading competencies among learners with intellectual disabilities. Using a structured review and analytical synthesis of fifteen peer-reviewed studies published between 2010 and 2024, the impact of UDL-aligned strategies on decoding, fluency,vocabulary, and reading comprehension was analysed. The findings indicate significant improvements in comprehension and vocabulary with moderate gains in decoding and fluency, particularly for learners with mild to moderate intellectual disabilities. However, limited evidence for learners with severe disabilities highlights important directions for future research within the Indian educational context.

Introduction:-

Reading is a foundational academic skill that underpins learning across curricular areas, supports effective communication, and promotes independence and social participation. Literacy competence enables individuals to access information, engage in lifelong learning, and participate meaningfully in community and vocational contexts. For students with intellectual disabilities (ID), however, the acquisition of reading skills is often significantly constrained by limitations in cognitive processing, working memory, language development, attention, and the ability to generalise learned skills across contexts (Browder et al., 2008; Spooner et al., 2015). These challenges frequently result in delayed or limited progress in decoding, fluency, vocabulary development, and reading comprehension, thereby restricting academic achievement and functional independence.

Despite global and national commitments to inclusive education, including the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) and policy frameworks such as the Rights of Persons with Disabilities (RPwD) Act, 2016 and the National Education Policy (NEP) 2020 in India, literacy instruction for learners with intellectual disabilities continues to rely heavily on uniform, teacher-centred pedagogical approaches.

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Such approaches often fail to address learner variability in inclusive classrooms, where students differ widely in cognitive abilities, learning pace, motivation, language proficiency, and access needs (McLeskey et al., 2014; Gupta & Sharma, 2018). Consequently, students with ID are at heightened risk of academic exclusion, reduced engagement, and poor literacy outcomes.

Universal Design for Learning (UDL) offers a theoretically grounded and empirically supported framework for addressing these challenges. Rooted in cognitive neuroscience, UDL emphasises proactive curriculum design that anticipates learner diversity and minimises barriers to learning from the outset (Meyer, Rose, & Gordon, 2014). The framework is structured around three core principles: providing multiple means of representation to support diverse ways of perceiving and understanding information; multiple means of engagement to sustain motivation and interest; and multiple means of action and expression to allow learners varied ways of demonstrating understanding (Hall, Meyer, & Rose, 2012). By embedding flexibility into instructional design, UDL shifts the focus from remediating learner deficits to adapting instructional environments.

In the context of reading instruction, UDL principles translate into the use of multimodal texts, assistive and digital technologies, explicit scaffolding, structured supports, learner choice, and flexible assessment practices (Marino & Beecher, 2010; Coyne et al., 2012). For students with intellectual disabilities, these features are particularly beneficial as they reduce cognitive load, enhance access to content, and promote active engagement with text (Meredith, Lippman-Bell, & Dymond, 2019). Research indicates that technology-enabled supports such as text-to-speech, visual cues, interactive multimedia, and graphic organisers can significantly enhance comprehension and vocabulary development among learners with ID (Gupta & Bhardwaj, 2021; Kumar, 2021).

International studies have demonstrated positive effects of UDL-aligned reading interventions on literacy outcomes for students with mild to moderate intellectual disabilities, particularly in inclusive classroom settings (Spooner et al., 2015; Fitzgibbons, O'Connor, & Freeman, 2024). Peer-mediated reading strategies and personalised learning approaches embedded within UDL frameworks have also been shown to improve learner engagement, motivation, and oral reading fluency (Katz & Sugden, 2013; Malhotra & Aggarwal, 2020). However, the evidence base remains fragmented, with considerable variation in intervention duration, instructional strategies, outcome measures, and participant characteristics.

Within the Indian educational context, empirical research on UDL-based reading instruction for students with intellectual disabilities remains limited. Existing studies have primarily focused on classroom engagement, general academic achievement, or technology use, rather than systematically examining specific reading competencies such as decoding, fluency, vocabulary, and comprehension (Das & Gupta, 2017; Kaur & Sharma, 2019). Moreover, contextual factors such as large class sizes, limited access to assistive technology, teacher preparedness, and variability between urban and rural school settings further influence the implementation and effectiveness of UDL practices in India (Gupta & Sharma, 2018).

Given these gaps, there is a pressing need for a systematic synthesis of empirical evidence examining the effectiveness of UDL-based instructional interventions in enhancing reading competencies among students with intellectual disabilities. Such a synthesis is essential to inform inclusive classroom practices, guide teacher education and professional development, and support policy-aligned implementation of inclusive literacy instruction. By critically reviewing national and international studies published between 2010 and 2024, the present study seeks to consolidate evidence on UDL-aligned reading interventions and identify practical implications for inclusive education in India.

In doing so, this study contributes to the growing body of literature advocating for flexible, learner-centred instructional frameworks that recognise diversity as a normative aspect of classrooms. Universal Design for Learning, when effectively implemented, holds significant potential to transform reading instruction for students with intellectual disabilities by promoting access, engagement, and meaningful participation in literacy learning.

Objectives of the Study:-

The present study was undertaken with the following objectives:

1. To evaluate the effectiveness of Universal Design for Learning (UDL)-based instructional interventions in enhancing the reading competencies—decoding, fluency, vocabulary, and comprehension—of students with intellectual disabilities.

2. To examine the relative impact of specific UDL-aligned instructional strategies, including digital and multimedia supports, graphic organizers, peer-mediated reading, and personalized learning approaches, on reading outcomes.
3. To systematically review and synthesize empirical evidence from national and international studies on UDL-based reading interventions published between 2010 and 2024.
4. To identify practical implications of UDL-based reading interventions for inclusive classroom practices, teacher education and professional development, and directions for future research within the Indian educational context.

Conceptual Framework: UDL and Reading Instruction:-

UDL emphasises proactive instructional planning that accommodates learner diversity from the outset. In reading instruction, UDL principles are operationalised through multimodal text presentation, explicit scaffolding, motivational supports, and flexible assessment methods. Students with intellectual disabilities benefit from these approaches as they reduce cognitive load, support comprehension, and promote active engagement with text.

Reading competencies encompass decoding, fluency, vocabulary, and comprehension. UDL-based reading instruction supports these components by embedding assistive features, structured supports, and learner choice within instructional materials, enabling students with intellectual disabilities to participate meaningfully in literacy activities.

Review of Literature:-

Existing research on reading instruction for students with intellectual disabilities consistently documents substantial challenges in developing decoding, reading fluency, vocabulary, and comprehension skills. These difficulties stem from limitations in cognitive processing, working memory, language development, and generalisation abilities, which collectively hinder academic achievement and functional literacy (Browder et al., 2008; Katims, 2000; Spooner et al., 2015; Allor et al., 2014). As a result, students with intellectual disabilities often have restricted access to curricular content and reduced participation in academic and social contexts (McLeskey et al., 2014; Westling & Fox, 2009). Conventional literacy instruction, characterised by uniform teaching approaches, textbook-driven content, and limited differentiation, has been widely recognised as insufficient to address the diverse cognitive, linguistic, and motivational profiles of these learners, particularly in inclusive classroom environments (Friend & Bursuck, 2019; Gupta & Sharma, 2018).

Early intervention studies in the field predominantly employed skill-based and behaviourist instructional models, including direct instruction, task analysis, systematic prompting, and repeated practice. These approaches yielded positive outcomes in basic decoding skills, letter–sound correspondence, and sight-word recognition (Browder et al., 2008; Ahlgrim-Delzell et al., 2011). However, their effectiveness in fostering higher-order reading processes—such as comprehension, inferencing, and transfer of skills across contexts—remained limited (Katims, 2000; Spooner et al., 2015). Such limitations highlighted the need for instructional frameworks that move beyond remediation and instead emphasise learner variability, accessibility, and meaningful engagement with text.

Universal Design for Learning (UDL) emerged as a theoretically robust and inclusive framework aimed at proactively reducing barriers to learning through flexible curriculum design. Grounded in cognitive neuroscience, UDL promotes the provision of multiple means of representation, engagement, and action/expression to accommodate diverse learning needs (Rose & Meyer, 2002; Meyer, Rose, & Gordon, 2014). Rather than adapting instruction retroactively, UDL encourages anticipatory planning that embeds accessibility within instructional materials and pedagogical practices. In literacy instruction, UDL has been shown to support diverse learners by integrating multimodal texts, assistive technologies, scaffolded supports, and flexible assessment strategies (Hall, Meyer, & Rose, 2012; Al-Azawei et al., 2016).

A growing body of international research has examined the impact of UDL-based reading interventions for students with intellectual disabilities. Marino and Beecher (2010) reported significant improvements in reading comprehension among learners with mild intellectual disabilities when UDL-aligned strategies—such as multimedia texts, visual supports, and explicit comprehension instruction—were employed. Similarly, Coyne et al. (2012) demonstrated that literacy instruction grounded in UDL principles enhanced access to grade-level content and resulted in notable gains in vocabulary and comprehension for students with significant cognitive disabilities. Spooner et al. (2015) further confirmed that UDL-based instruction positively influenced academic engagement and reading-related outcomes among learners with severe developmental disabilities.

Recent research has placed particular emphasis on technology-supported UDL interventions. Studies indicate that digital tools, including text-to-speech, interactive multimedia, graphic organisers, and visual prompts, reduce cognitive load and support comprehension and vocabulary acquisition among students with intellectual disabilities (Meredith, Lippman-Bell, & Dymond, 2019; Okolo & Bouck, 2007). Empirical evidence from Indian and international contexts suggests that technology-enabled reading instruction enhances learner motivation, accessibility, and comprehension when aligned with UDL principles (Gupta & Bhardwaj, 2021; Kumar, 2021; Dalton & Proctor, 2007).

Peer-mediated and collaborative learning strategies embedded within UDL frameworks have also shown promise in improving reading outcomes. Katz and Sugden (2013) reported that peer-assisted learning within UDL-based classrooms enhanced learner engagement, social interaction, and oral reading fluency. Similarly, Malhotra and Aggarwal (2020) found that UDLaligned collaborative practices promoted self-determination and active participation among learners with intellectual disabilities. More recently, Fitzgibbons, O'Connor, and Freeman (2024) demonstrated that peer-mediated reading interventions in inclusive classrooms positively influenced engagement and fluency, although improvements in higher-order comprehension varied across learner profiles.
Within the Indian educational context, empirical research on UDL-based instruction remains limited but is gradually emerging. Gupta and Sharma (2018) documented improvements in classroom engagement, attention, and task persistence among students with mild intellectual disabilities following the implementation of UDL-aligned instructional practices. Kaur and Sharma (2019) similarly reported significant gains in overall academic achievement, including reading-related skills, when UDL principles were systematically integrated into classroom instruction. However, most Indian studies have focused on general academic outcomes, technology integration, or classroom engagement rather than conducting detailed analyses of specific reading competencies such as decoding, fluency, vocabulary, and comprehension (Das & Gupta, 2017; Malhotra & Aggarwal, 2020).

Despite these encouraging findings, the existing literature is constrained by several methodological limitations. Many studies employ small sample sizes, short intervention durations, and heterogeneous outcome measures, limiting the generalisability and comparability of findings (Spooner et al., 2015; Al-Azawei et al., 2016). Furthermore, learners with moderate-to-severe intellectual disabilities remain underrepresented in UDL-based reading research, and evidence regarding long-term sustainability, implementation fidelity, and classroom-wide application—particularly in low-resource and government school settings in Indiaremains sparse (Gupta & Sharma, 2018; McLeskey et al., 2014).

Methodology:-

Research Design:-

The study adopted a descriptive and analytical research design based on a structured review of empirical literature on UDL-based reading interventions for students with intellectual disabilities.

Sources of Data:-

Relevant studies were identified through electronic searches of ERIC, JSTOR, ScienceDirect, Google Scholar, and selected Indian education journals.

Inclusion Criteria:-

Studies were included:-

1. Explicitly reported the use of UDL principles in reading instruction;
2. Included participants identified with intellectual disabilities;
3. Reported measurable outcomes related to reading competencies;
4. Were published between 2010 and 2024 in peer-reviewed journals.

Sample of Studies:-

Following screening and eligibility checks, fifteen empirical studies were selected for detailed analysis. These studies included experimental, quasi-experimental, and intervention-based designs.

Data Analysis:-

The selected studies were analysed in terms of participant characteristics, instructional strategies, alignment with UDL principles, and reported reading outcomes. Findings were synthesised thematically and organised according to major UDL-based instructional approaches.

Results and Findings:-

Objective 1.:-To evaluate the effectiveness of Universal Design for Learning (UDL)-based instructional interventions in enhancing the reading competenciesdecoding, fluency, vocabulary, and comprehensionof students with intellectual disabilities.

With respect to evaluating the effectiveness of UDL-based instructional interventions in improving reading competencies—decoding, fluency, vocabulary, and comprehension—most reviewed studies reported significant improvements in reading comprehension and vocabulary development, particularly among students with mild to moderate intellectual disabilities. Gains in decoding and reading fluency were observed across several studies, although these improvements were generally moderate and less consistent compared to comprehension outcomes.

Objective 2:-To examine the relative impact of specific UDL-aligned instructional strategies, including digital and multimedia supports, graphic organizers, peer-mediated reading, and personalized learning approaches, on reading outcomes.

Digital and Multimedia-Based Reading Interventions:-

In relation to examining the impact of specific UDL-aligned strategies, digital and multimedia-based reading interventions emerged as the most frequently reported and effective approach. Studies consistently indicated that features such as text-to-speech, visual cues, animations, and interactive digital activities enhanced reading comprehension and vocabulary development. These tools reduced cognitive load, supported sustained attention, and enabled learners to access text through multiple sensory modalities, aligning closely with UDL principles of representation and engagement.

Graphic Organisers and Scaffolded Instruction:-

Studies employing graphic organisers, story maps, and scaffolded questioning strategies demonstrated significant improvements in reading comprehension. These approaches helped learners identify key ideas, understand text structure, and organise information meaningfully. Graphic organisers were particularly effective in supporting inferential comprehension and recall, highlighting their role in strengthening higher-order reading processes for students with intellectual disabilities.

Peer-Mediated Reading Strategies:-

Peer-mediated and peer-assisted reading strategies were found to positively influence learner engagement, oral reading fluency, and classroom participation. While gains in higher-order comprehension were variable, these strategies consistently enhanced motivation, social interaction, and sustained attention, thereby supporting inclusive classroom participation. The findings suggest that peer-mediated approaches are particularly valuable for promoting engagement and fluency within UDL-based instructional environments.

Personalised Learning and Learner Choice:-

UDL-aligned practices that incorporated personalised learning elements—such as learner choice in reading materials, assistive tools, and response formats—were associated with increased motivation, task persistence, and learner autonomy. Although direct effects on decoding accuracy and fluency were limited, these practices contributed significantly to engagement and self-regulation, reinforcing the importance of motivational supports within UDL frameworks.

Objective 3:- To systematically review and synthesize empirical evidence from national and international studies on UDL-based reading interventions published between 2010 and 2024.

The systematic synthesis of fifteen empirical studies published between 2010 and 2024 revealed that UDL-based reading interventions are most effective when multiple UDL principles are implemented concurrently, rather than in isolation. Interventions combining digital supports, scaffolded instruction, and flexible response options demonstrated stronger and more sustained reading outcomes compared to single-strategy approaches. However, variations in study design, intervention duration, sample size, and outcome measures limited direct comparability across studies**.**

Objective 4:- To identify practical implications of UDL-based reading interventions for inclusive classroom practices, teacher education and professional development, and directions for future research within the Indian educational context.

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Discussion:-

The present review demonstrates that UDL-based reading interventions are effective in enhancing reading competencies among students with intellectual disabilities (ID), particularly those with mild ID. Interventions incorporating technology-supported strategies, multimedia resources, scaffolded instruction, graphic organisers, peer-mediated reading, and personalised learning consistently showed improvements in reading comprehension and vocabulary, with moderate gains in decoding and fluency. These findings reinforce the theoretical premise of UDL, which emphasises multiple means of representation, engagement, and action/expression to accommodate learner variability and reduce barriers to learning.

Indian studies further highlight the influence of contextual factors, including resource availability, classroom environment, teacher preparedness, and administrative support, on the effectiveness of UDL interventions (Das & Gupta, 2017; Gupta & Sharma, 2018; Kaur & Sharma, 2019). Technology-supported strategies were particularly effective due to their flexibility, adaptability, and ability to present content in multiple formats, enabling learners to access, process, and engage with text more meaningfully. Peer-mediated and personalised approaches enhanced learner motivation and engagement, supporting active participation and fostering autonomy.

Despite these positive outcomes, several limitations constrain the generalisability of findings. The predominance of short-term studies with small sample sizes, coupled with the limited inclusion of learners with moderate-to-severe ID, restricts the broader applicability of results. Additionally, implementation fidelity, integration with curricula, and sustainability of interventions in low-resource and government school settings remain underexplored. These gaps underscore the need for longitudinal, school-based research that evaluates sustained impact across diverse educational contexts in India.

Overall, the evidence suggests that UDL provides a practical and flexible framework for designing inclusive reading instruction that can accommodate diverse learner needs, enhance comprehension, and foster engagement. The success of UDL interventions is closely linked to teacher competence, availability of instructional resources, and systemic support within schools, highlighting the importance of a holistic approach to implementation.

Educational Implications:-

- Teachers should integrate UDL-based instructional practices as a core component of reading instruction for students with ID.
- Multimedia supports, graphic organisers, and scaffolded instruction can improve literacy access, comprehension, and information organisation.
- Flexible assessment methods allow learners to demonstrate understanding through oral, visual, and project-based formats, beyond traditional written tasks.
- Schools should encourage collaboration between general and special educators to enhance inclusive planning and instruction.
- Teacher education programs should emphasise practical application of UDL principles, including the use of digital tools, scaffolds, and personalised learning strategies.
- Institutional support, including access to resources and ongoing professional development, is essential for sustainable implementation.

Suggestions for Further Research:-

- Conduct longitudinal studies to examine the sustained impact of UDL-based reading interventions.
- Include learners with moderate-to-severe intellectual disabilities to broaden evidence applicability.
- Investigate UDL implementation in low-resource, rural, and government school contexts.
- Explore teacher preparedness, fidelity of implementation, and systemic barriers affecting UDL adoption.
- Undertake empirical classroom-based studies across diverse Indian contexts to strengthen the evidence base and inform scalable inclusive practices.

Conclusion:-

Universal Design for Learning (UDL) provides a comprehensive, flexible, and evidence-based framework for enhancing reading competencies among students with intellectual disabilities. This review demonstrates that UDL-aligned interventions—particularly those integrating technology, multimedia supports, scaffolded instruction, graphic organisers, peer-mediated strategies, and personalised learning—significantly improve reading comprehension and vocabulary, with moderate gains in decoding and fluency. The effectiveness of these interventions is closely tied to teacher preparedness, instructional resources, classroom environment, and institutional support.

In the Indian educational context, adopting UDL has far-reaching implications for inclusive literacy education. It can facilitate meaningful participation of learners with ID in mainstream classrooms, promote autonomy, reduce barriers created by uniform pedagogical approaches, and foster equitable access to learning. Furthermore, UDL provides a structured approach for integrating assistive technology, differentiated instruction, and flexible assessment, collectively enhancing both engagement and learning outcomes.

Nonetheless, the current evidence base is limited by short-term studies, small sample sizes, and underrepresentation of learners with moderate-to-severe ID. There is an urgent need for rigorous, longitudinal, and contextually grounded research that evaluates the sustained impact of UDL interventions across diverse learner populations and school settings. Future studies should also examine implementation fidelity, teacher professional development, and alignment with local curricula and policy frameworks, including the RPwD Act 2016 and the National Education Policy (NEP) 2020.

Integrating UDL into classroom practice not only enhances literacy outcomes but also strengthens inclusive education by addressing learner variability, fostering equitable access, and empowering students with intellectual disabilities to achieve their full academic potential. By translating research evidence into practical instructional strategies, Indian schools can advance inclusive literacy education and support meaningful, lifelong learning for all students.

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