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Systematic Review of the Early Interventions in Developing Academic Skills in Children with Intellectual Disabilities

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ABSTRACT Children with intellectual disabilities (ID) struggle a lot to learn basic academic skills. The goal of this systematic review was to assess how will the efficacy of early interventions to foster academic skills in children with intellectual disabilities. The researchers followed the PRISMA guidelines using 10 papers through methodological and thematic synthesis, following the use of stringent inclusion criteria. The best interventions are those that are tailored to the individual, make use of technology, and are integrated into organised curricula or family-supported learning settings to enhance reading, maths, and matching abilities. Significant benefits were also made through structured literacy programs and parent-mediated support. Children with mild intellectual impairment made the most from academic progress, while the severity of the impairment was the greatest moderator of outcomes. The rate of progress was affected by age, but gender had no impact on the results of the intervention. The review concludes the best early interventions.

INTRODUCTION

Intellectual disability is a neurodevelopmental disorder categorised by significant deficits in cognitive functioning (IQ below 70) and difficulties with adaptive skills, typically exhibiting before the age of 18. Intellectual disability (ID) is a neurodevelopmental disorder that begins before the age of 18 and is marked by significant limitations in intellectual functioning (usually an IQ of less than 70) and adaptive behaviour (American Psychiatric Association 2013). Between 1 percent and 3 percent of all children are affected by intellectual disability (Maulik et al. 2011). These manifest as a deficiency in conceptual, practical, and social abilities, interpersonal skills, social responsibility, self-esteem, gullibility, naivety, problem-solving skills, and adhering to the law. The capacity to understand language, finance, and time, are all examples of conceptual abilities. The ability to use tools, perform activities of daily living, and engage with others are all examples of practical skills (Lee et al. 2025). In bridging the educational divide between youngsters with ID and their normally developing peers, early intervention is widely accepted as essential (Fletcher et al. 2018), in the form of shifting from traditional behavioural approaches to evidence-based, holistic educational methods that combine individualised curriculum, interactive learning strategies, and the use of AI-supported technology (Alsolami 2025; Kim et al. 2025). Recent research suggests that interventions implemented in preschool or the early years of primary education can have lasting positive impacts on academic skills, particularly when tailored to each child's needs and involving families and teachers (Fernell et al. 2011; Rakap and Balikci 2025), and studies consistently prove that earlier and more intensive support results in superior cognitive and functional outcomes (Johnson 2016). However, knowledge stays limited about the effectiveness of these programs in different cultural contexts, as well as the varying levels of intellectual disability and the tools used to measure academic progress.

Current scholarship emphasises a paradigm shift from purely behavioural models (such as applied behaviour analysis) to integrative, individualised frameworks that incorporate structured pedagogy, family participation, and technology-enhanced learning, and have shown positive results. Research in Arab contexts, such as the Alsolami's (2025) study in Saudi Arabia, is still scarce but of great importance, showing the potential for generalising these interventions in diverse educational settings. So, this systematic literature review, conducted following the PRISMA (2020) principles, aims to analyse and evaluate recent evidence on the effectiveness of early intervention programs in developing academic skills (reading, writing, mathematics, and pre-academic skills) in children

with intellectual disabilities. In a similar vein, Kurzeja et al. (2024) showed that even among children with moderate ID, computer-assisted instruction, specifically phonics-based programs like Headsprout, results in significant improvements in phonological awareness and decoding when instruction is structured and systematic.

The theoretical background of the development of academic skills among the children with intellectual disabilities originated from different theories. Firstly, the theory of Piaget which is focused on the stages of cognitive development as a central factor in children's learning, wherein Vygotsky (1978) added the concept of the Zone of Proximal Development (ZPD), which forms the basis for early educational interventions for children with intellectual disabilities. Programs such as Headsprout Early Reading (Herring and Kovshoff 2023) and Children's School Success (Lieber et al. 2008) are constructed to provide progressive support tailored to the child's intellectual level. Prompting instruction and reducing aid are used to enable the child to complete academic tasks first with support and then independently (Rakap and Balikci 2025). This explains the success of interventions based on structured, progressive learning in enhancing reading and numeracy skills. Secondly, Bandura's theory (1977) suggests that learning occurs not only through repetition and stimulation, but also through observation, imitation, and participation in meaningful social scenarios (Egele et al. 2025). Additionally, new evidence highlights the family's role as a co-educator. Tiengsomboon and Luvira (2024) discovered that children's academic drive and performance greatly increase when parents change their home environments to reflect their child's learning profile. Additionally, Schuengel et al. (2023) contend that co-designed interventions, created in collaboration with families, improve both implementation fidelity and emotional well-being, an insight that was largely missing from earlier, top-down models. The results of the study by Yao et al. (2024) show that the presence of children with intellectual disabilities in inclusive classrooms goes beyond physical presence, as it depends on the quality of their interaction with the social environment, which aligns with the concepts of "observational learning" and "supportive learning environments". On the other hand, Kim et al. (2025) point out that inclusion may not help youngsters with moderate to severe ID unless it is accompanied by intensive, targeted instruction, which raises equity issues with universal laws. Thirdly, Gardner's theory asserts that intelligence has multiple dimensions, encompassing diverse types such as linguistic, logical-mathematical, spatial, and kinaesthetic intelligence (Gardner 1983) with Personalised Learning Applications.

The abilities of children with intellectual disabilities are often heterogeneous, wherein a child may experience language delays while having visual or kinaesthetic intelligence. Therefore, modern interventions rely on personalising educational content based on individual strengths. This principle is highlighted by the study by Alsolami (2025), where artificial intelligence was used to personalise specific academic activities (such as picture matching and letter sequencing) according to each child's preferred learning style, resulting in significant improvement. Despite these advancements, there are still significant gaps. Most interventions target moderate ID, with few options for extreme or severe situations. The literature is conspicuously lacking in writing, a fundamental academic ability. Moreover, there is a dearth of systematic synthesis looking at how the interaction between intervention design, child characteristics (such as age and severity), and contextual variables affects academic outcomes in different global contexts.

The study by Guo and Keles (2025) also emphasises that involving the family in naming a child's interests and strengths enhances intrinsic motivation and learning effectiveness. A theoretical understanding of how children with intellectual disabilities learn is fundamental to the success of early intervention programs. Successful intervention must also be social and cognitively structured. Evidence from given case studies underscores this theoretical integration, particularly in research that has successfully enhanced academic skills using strategies reflecting these three principles.

The Research Gap

Children with intellectual disabilities still face a gap in academic performance compared to their normal developing peers. Many curricula are not adapted to their intellectual abilities in regard to fulfilling their regular needs, leading to their exclusion from learning opportunities, even in supposedly inclusive settings. Furthermore, the effectiveness of early intervention programs may vary based

on the type of the academic skills such as reading, the variables that affect the effectiveness of programs (child's age, sex, and the severity of the disability), and the pattern of the intervention program of academic skills of children with intellectual disabilities. Therefore, the problem of this study lies in the lack of a wide-ranging systematic picture of the effectiveness of early interventions on the academic skills of children with intellectual disabilities, which complicates evidence-based decision-making for policymakers and educators.

Objectives

This systematic literature review aims to determine which types of academic skills of children with intellectual disabilities are the most common in the previous research, identify the most common variables that affect the effectiveness of programs (child's age, sex, and the severity of the disability), and verify the most common patterns of the intervention programs in improving the academic skills of children with intellectual disabilities.

Study Questions

This systematic review looks to answer the following questions:

Question 1: Which types of academic skills of children with intellectual disabilities are the most common in the earlier research?

Question 2: What are the most common variables that affect the effectiveness of programs (child's age, sex, and the severity of the disability)?

Question 3: What are the most common patterns of the intervention programs in improving the academic skills of children with intellectual disabilities?

METHODOLOGY

Protocol and Registration

This study followed a systematic literature review method according to the PRISMA 2020 criteria (Page et al. 2021; Shamseer et al. 2015), exploring the empirical evidence about the efficacy of early intervention programs to enhance academic skills (such as reading, writing, arithmetic, and pre-academic skills) among the children (0-12 years) with intellectual disabilities.

Requirements for Eligibility

The inclusion and exclusion criteria used to select studies for this review included research that was released up to 2025. The samples included children between the ages of 0 and 12 who had received a clinical diagnosis of intellectual disability, the first interventions emphasised quantifiable academic abilities, and the quasi-experimental or experimental research design (includes case studies with control).

Exclusion Criteria

Research that just considers interpersonal or social skills, excluding academic achievement, were excluded from the present study. Other exclusion criteria were essays that are theoretical or express opinions, studies of other disorders (for example, autism spectrum disorder, but exclusively without a known intellectual impairment), and the Process of Selecting Studies (PRISMA), and the findings being restricted to social or behavioural abilities while not addressing scholastic talents.

Data Extraction

A standardised form was used to collect the following information from each study, including authors, year, and country, sample characteristics (age, severity of disability, age), type of intervention (digital, family, classroom, behavioural), and academic skills targeted.

The studies were assessed according to the Cochrane Scale for Randomised Trials, and the SCARF Framework for Single-Case Studies. The assessment included randomness and group distribution, sample integrity (absence of withdrawals), objectivity of outcome measurement, researcher bias, and the analysis and synthesis (Pérez et al. 2020; Selçuk 2019). Due to differences in research designs and measurement tools, a thematic synthesis analysis was used to classify interventions based on intervention type (embedded family support learning, artificial intelligence, voice learning).

Data Sources

The electronic databases and other sources that were searched included Web of Science and Scopus.

Search Strategy

The search strategy used keywords and Boolean operators. Data were collected from records from the Web of Science and Scopus databases, using a bibliographic search using the keywords ("early intervention" OR "early program") AND ("intellectual disability" OR "mental retardation" OR "developmental disability") AND ("academic skill" OR "literacy" OR "numeracy" OR "reading" OR "writing" OR "math") AND ("child" OR "preschool" OR "school-age"). Researchers specialising in early intervention and developmental disabilities, helped verify the correlation of studies and the credibility of authors, references with abstracts and direct DOI links.

Choosing Research

There were two phases to the procedure of choosing the research. The first included screening of the abstracts and titles of the studies that were discovered were reviewed by two independent reviewers (Reviewer A and Reviewer B) to decide whether they satisfied the inclusion and exclusion criteria. Then, a Full Text Review by the same two reviewers who analysed full-text papers from potentially eligible trials to find eligibility. All disagreements were resolved through discussion or by contacting Reviewer C, a third reviewer. A Cohen's Kappa statistic was used during the screening and full-text review processes to assess the interrater reliability between the reviewers (Pérez et al. 2020).

Data Retrieval

Using a data extraction form, the selected studies underwent a regulated process of data extraction. The data points included approach to research (for example, quasi experimental, single case), the intervention's specifics, including the kind, theoretical framework, length, intensity, setting, and implementation fidelity, and measures of outcomes, such as standardised tests, parent reports, and teacher rankings. The data extraction form was tested on a part of the included research to ensure clarity and consistency. The data from each study was gathered by two independent reviewers (Reviewer D and Reviewer E), and any disagreements were resolved via conversation or consultation with a third reviewer (Reviewer F) (Bignon and Vuillemey 2020).

Quality Assessment

The methodological quality of the included studies was carefully assessed using established, design-specific quality appraisal tools. For randomised controlled trials (RCTs), the Cochrane Risk of Bias tool (Flemyng et al. 2023) was used to evaluate domains such as random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other potential sources of bias. The What Works Clearinghouse (WWC) Standards (Bignon and Vuillemey 2020) were applied to single-case experimental designs to evaluate key indicators such as experimental control, fidelity of implementation, and reliability of outcome measures. Two reviewers, Reviewer G and Reviewer H, rated each research independently using the guidelines outlined in the corresponding tools. The quality assessment process was carried out independently by the two reviewers. Transparency, consistency, and reliability in the evaluation procedure were ensured by resolving any differences in opinion via organised discussion, and when agreement could not be reached, a third reviewer (Reviewer I) was consulted to make the ultimate decision (Pérez et al. 2020).

Data Synthesis

The results of the included studies were summarised and presented in a well-organised manner using a narrative approach to data synthesis. A metanalysis was deemed inappropriate due to the variety of interventions and outcome measures. The following are the steps involved in the narrative synthesis:

- Arranging Results: Grouping studies according to the kind of intervention
- Description of Interventions: Thorough explanation of the theoretical framework for each intervention
- Presentation of Results: Providing a summary of the results of each study, including the statistical significance, and effect sizes of the outcomes
- Assessment of Consistency: Considering variables like the child's age, sex, and disability degree, types of academic Skills, intervention pattern, evaluate how consistent the findings are across studies

- Pattern Identification: Finding common patterns across studies, emphasising the most effective intervention
- Quality Consideration: Giving more weight to research with higher quality, considering the methodological quality of the involved studies (Pérez et al. 2020; Selçuk 2019).

RESULTS

Choosing Studies

Figure 1 describes the flow of information during the systematic review process. Database searches initially turned up 114 records, including 27 from Scopus and 87 from Web of Science. After applying the PRISMA 2020 screening criteria and removing duplicates, 104 records were eliminated for factors such as age outside the 0-12 range, intellectual disability (with or without other disabilities), and early interventions aimed at academic skills. The main reasons for the exclusion were the age range falling outside the criteria, the results being limited to social or behavioural skills without addressing academic skills, the lack of a clear emphasis on intellectual disability, or inadequate methodological data (such as the absence of a description of the intervention or measurement tools). In the end, ten studies were chosen for thematic and methodological synthesis because they satisfied all inclusion criteria. The major aspects of these ten studies are listed in Table 1, along with the authors, intervention types, target academic skills, and the impact of child-level factors like age, gender, and disability severity. A thorough review of the literature reveals consistent trends in Table 1.

Characteristics of the Study

The participants, intervention methods, and study designs all differed amongst the included trials. Table 1 lists a summary of the study's characteristics including the details such as study, author(s), most common type of early intervention, influence of child's age, sex, and disability severity, and types of academic skills targeted.

Quality Assessment

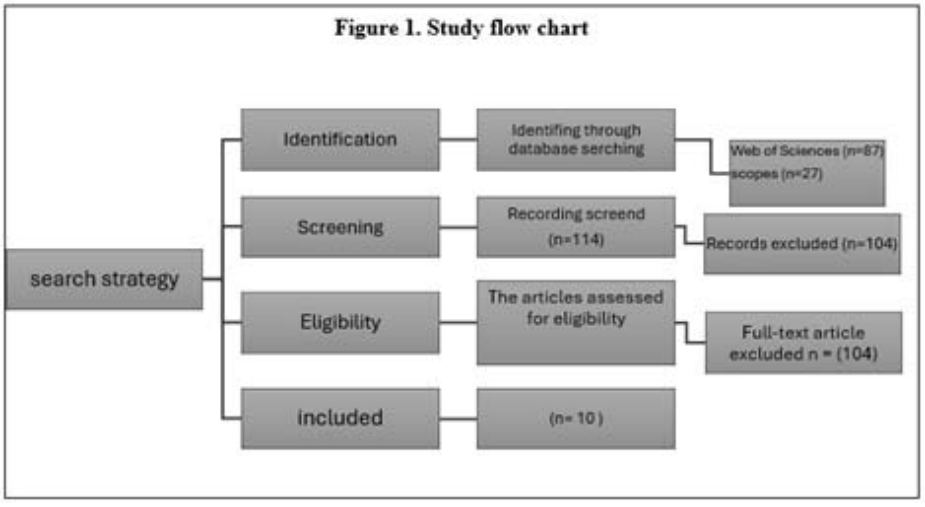
The methodological quality of included studies ranged from low to high. A summary of the quality assessment ratings is presented in Table 1 summarising the quality assessment ratings for each included study, using the chosen quality assessment tool.

Merging the Results

This systematic review merged data about three major research issues:

1. Which types of academic skills of children with intellectual disabilities are the most common in the previous research?
2. What are the most common variables that affect the effectiveness of programs (child's age, sex, and the severity of the disability?

Figure 1. Study flow chart



3. What are the most common patterns of the intervention programs in improving the academic skills of children with intellectual disabilities?

Question 1: Which types of academic skills of children with intellectual disabilities are the most common in the earlier research?

Pre-academic Skills

Table 1 shows that pre-academic skills are the most common, as these skills are the foundation of any early intervention and include visual matching, letter and number recognition, classification, and print awareness. In the Alsolami (2025) study, "matching" was one of the key skills where improvement was measured after the use of artificial intelligence. The Children's School Success curriculum (Lieber et al. 2008) also focused on these skills in the preschool years, considering them a predictive indicator of later academic success.

Literacy and Phonological Awareness Skills

Table 1 shows a strong focus on developing early literacy skills, particularly phonological awareness, word recognition, and reading fluency. The Headsprout Early Reading program (Herring and Kovshoff 2023) systematically targeted enhancing the ability to segment words into sounds, which resulted in a significant improvement in non-real words and reading real. A systematic review (Alquraini and Rao 2022) also suggested that structured reading interventions are among the most effective strategies for individuals with intellectual disabilities.

Numeracy Skills

Numeracy skills include counting, number recognition, quantitative comparison, and simple arithmetic operations. A study by Fernell et al. (2011) showed that children with typical cognitive performance make gains in numerical skills when receiving intensive behavioural intervention. A systematic review of numerical interventions (also showed that the use of concrete materials, blocks or cards) improves numerical understanding in this group (Rakap and Balikci 2025).

Writing and Written Expression Skills

Despite their importance, interventions targeting writing are least common and often limited to simple dictation, expressive drawing, or the use of alternative communication tools (such as picture boards or digital applications) to support written expression. In a study by Wakeman et al. (2024) students with severe disabilities were supported in developing basic writing skills through adaptive modifications. The study by Neto and Aquino (2009) showed the use of augmentative communication systems to enable children to express themselves in writing despite their limited motor abilities.

Despite the diversity of academic skills targeted, interventions always begin with pre-academic skills as a fundamental entry point, then progress towards reading and arithmetic, while writing remains one of the least addressed areas, often due to the motor and linguistic challenges associated with intellectual disability. This progression reflects the logic of scaffolding, then expands to include more complex skills and where the intervention builds on what the child can do (Kim et al. 2025).

Question 2: What are the most common variables that affect the effectiveness of programs (child's age, sex, and the severity of the disability)?

Evidence from the reviewed studies writes down that individual child characteristics play a pivotal role in determining the effectiveness of early interventions. These characteristics are ranked from most to least influential as follows.

Severity of Intellectual Disability

The severity of the disability (mild, moderate, severe) is the most influential and strongest predictor of a child's response to academic intervention. In the study by Fernell et al. (2011), not all children showed equivalent improvement, as progress was limited to the group with normal or near-normal cognitive performance, while those with moderate or severe disabilities showed limited gains in academic skills. Similarly, the Alsolami (2025) study, the only one that targeted a homogeneous group, focused only on children with mild intellectual disability, suggesting that digital intervention may not be effective for those with more profound cognitive impairments. These findings suggest that academic interventions are often de-

Table 1: Characteristics of included studies

Author(s) Year	*Title*	*Most common type of early intervention*	*Influence of child's age, sex and disability severity*	*Types of academic skills targeted*
Alsolami 2025	The effectiveness of using artificial intelligence in improving academic skills of school-aged students with mild intellectual disabilities in Saudi Arabia	Reading and numeracy	Age: 9-12 years Severity: mild ID onlySex: all male sample	Individualised teaching driven by artificial intelligence (an emerging alternative to ABA)
Rakap and Balikci 2022	Investigating the impact of embedded learning opportunities on the engagement of children with autism and intellectual disability	Numeracy and literacy activities within classroom routines	Age: preschool (2-5 years) Severity: mild to moderate ID Sex: not showed	Opportunities for embedded learning (naturalistic ABA-based strategy)
Fernell et al. 2011	Early intervention in 208 Swedish preschoolers with autism spectrum disorder	Adaptive behaviour as proxy for school readiness	Age: 3-5 years at the beginning Severity: the group with an average IQ gained th mixed.	Intensive versus non-intensive ABA-based therapy
Kim et al. 2025	A meta-analysis of interventions for elementary students with intellectual disability in general education settings	Reading, writing and math	Age: 6-12 years Severity: mostly mild IDSex: not analysed as variable	Prompting systems based on ABA (for example, least-to-most prompting)
Guo and Keles 2025	A systematic review of studies with parent-involved interventions for children with specific learning disabilities	Reading and numeracy practice	Age: school-aged (6-12) Severity: learning disabilities (often overlapping with mild ID)Sex: not emphasized	Academic help mediated by parents (often coupled with behaviour interventions)
Tiengsomboon and Luvira 2024	Family support for children with learning disabilities to reach good academic performance: A qualitative study	Homework support and emotional scaffolding	Age: 6-12 years Severity: learning difficultiesSex: caregivers for both boys and girls	Family-based comprehension and modification of the learning environment
Yao et al. 2024	Much more than just being present: Participation of children with intellectual disabilities in mainstream schools	literacy, numeracy, life-skills and after-school activities	Age: of school age Severity: different degrees of IDSex: not emphasised	Inclusive education with teacher/ peer support (not ABA-specific)
Lieber et al. 2008	Accessing the general curriculum: Including young children with disabilities in preschool	Print awareness, early literacy and numeracy	Age: preschool (3–5 years) Severity: mild ID Sex: not examined	The Children's School Success curriculum (universal design + structured instruction)
Herring and Kovshoff 2023	Investigating the use of Headsprout Early Reading with students with intellectual disability	Phonological awareness, word recognition, nonsense word fluency	Sex: unspecified Age: of school age Severity: moderate ID	Computer-assisted instruction with a structured phonics foundation (ABA-informed)
El Khayat et al. 2012	Intelligent serious games system for children with learning disabilities	Basic numeracy, symbol recognition and visual matching	Age range: 7-9 years Severity: learning impairments/mild IDGender: unknown	Educational games with adaptive input that are serious

signed to suit minimum cognitive abilities, limiting their generalisability to all levels of disability.

Table 1 shows age at the start of the intervention is a crucial factor in its success. The earlier the intervention begins, ideally before the age of 7, the better the results, as shown in the studies by Fernell et al. (2011) and Rakap and Balikci (2025), which focused on the preschool stage (2-6 years). The literature shows that the brain at this stage is more malleable (neuroplasticity), easing the acquisition of basic skills. In contrast, Alsolami's (2025) study shows that interventions can be effective even at ages 9-12 years, but only if they are intensive and individualised, showing that age is not entirely decisive, but rather a strong indicator of the speed of response and the extent of improvement. Table 1 shows that even though current research does not show any notable disparities in the cognitive reaction of boys and girls to academic treatments for children with intellectual impairments, it consistently shows that boys are more likely to be diagnosed with intellectual and learning disabilities (Tiengsomboon and Luvira 2024).

In addition, some research shows that males are more prone than girls to engage in externalising behaviours such as hyperactivity and conduct impulsivity (Brooks et al. 2015). Even though these behavioural traits may have an impact on classroom participation or need extra behavioural support, they do not automatically diminish the child's ability to learn if the right individualised approaches are used. In conclusion, a person's gender is not a clear indicator of how successful academic intervention will be. Rather, it serves as a marker of risk and prevalence, and sometimes as a moderator of behavioural comorbidities that may have an indirect impact on learning environments.

Question 3: What are the most common patterns of the intervention programs in improving the academic skills of children with intellectual disabilities?

The Effectiveness of Technological and AI-Based Interventions

The most dependable and statistically significant results come from technology-mediated interventions. Alsolami (2025) implemented an AI-powered adaptive learning approach with 70 Saudi boys between the ages of 9 and 12 who had mild ID. The experimental group proved significant and long-lasting improvements in matching, reading, and numeracy, with effect sizes between moderate to high, far beyond what is usually seen in ABA outcomes.

The AI system customised content in real time, overcoming social communication obstacles that often hinder traditional instruction. By using the Headsprout Early Reading program, a systematic, computer-assisted phonics program, Herring and Kovshoff's 2023 study proved that cognitive-focused digital tools are superior to behavioural ones in fostering literacy development, as seen by the notable improvements in phonological awareness, word identification, and fluency in nonsense words. These interventions are effective because they provide quick, unbiased comments, allow for frequent, self-paced practice in a stress-free environment, and adapt to the student's skill level as needed.

The Impact of Well-Structured Academic Procedures and Parental Support

Programs based on the curriculum, like Children's School Success (Lieber et al. 2008), which incorporates literacy and numeracy into play-based preschool schedules. Parent-mediated academic support (Guo and Keles 2025; Tiengsomboon and Luvira 2024), where caregivers are trained to help their children enhance their abilities at home. They often produce mild outcomes and are more often complementary than independent remedies, in contrast to methods based on artificial intelligence.

The researcher concluded that the most effective approach is AI-driven adaptive learning systems. These methods concentrate squarely on academic content with accuracy, personalisation, and scalability, leading to greater and more enduring gains as opposed to behaviourally oriented strategies. Future studies should look at incorporating these models with family and school-based support and extending them to various cultural contexts.

Despite the widespread use of ABA-based techniques, such as discrete trial training and prompting hierarchies, especially in autism-ID comorbidity situations like Fernell et al. (2011), the outcomes are mostly evaluated in terms of adaptive behaviour (using Vineland scales) or engagement rather than academic achievement. As an illustration, Rakap and Balikci (2025) did not mea-

sure gains in literacy or numeracy even though Embedded Learning Opportunities (an ABA-derived technique) improved participation in academic activities. According to Kim et al. (2025), the effect size of ABA-based prompting in inclusive classrooms was only moderate, and there was significant variability among students. Most notably, Fernell et al. (2011) emphasised that only children with nearly average cognitive abilities showed substantial improvement, and that the improvement was in behavioural changes rather than reading or math ability.

DISCUSSION

Early interventions can significantly improve the academic abilities of youngsters with intellectual impairments, but only when they are tailored, developmentally right, and integrated into supportive ecological systems. According to this systematic study, focusing on nine important trials that matched the inclusion criteria, revealed that early intervention programs are unquestionably successful in enhancing academic abilities in youngsters with intellectual disabilities, but only if they are structured following the principles of individualisation and contextual interaction. Recent data from 2024-2025 highlights the revolutionary potential of artificial intelligence in tailoring education for children with moderate intellectual impairment. The study conducted by Alsolami (2025) in Saudi Arabia found medium to big effect sizes for AI-driven reading and numeracy gains in 9- to 12-year-old boys, emphasising not only cognitive advantages but also greater engagement, perhaps because such systems reduce the social-communication obstacles that often plague traditional instruction. In a similar vein, El Khayat et al.'s (2012) research proved that an Intelligent Serious Games system enhanced the academic ability of 20 children (aged 7-9) who had learning challenges, notably in visual and numerical abilities, further supporting the potential of digital technologies to ease individualised and adaptive learning.

Likewise, Kurzeja et al. (2024) systematically reviewed computer-assisted teaching and found that phonics-based digital tools like Headsprout greatly enhance phonological awareness and decoding skills, even in youngsters with moderate intellectual disabilities, if the instruction is scaffolded and error-corrected in real time. These results stand for a shift in emphasis from compliance to academic subject matter and call into question the historical supremacy of behavioural models.

Furthermore, the research showed that the family context is essential to improving the efficacy of these interventions. Guo and Keles's (2025) systematic review revealed that including the family in learning activities (such as shared reading, helping with numeracy skills, and tracking daily progress) was linked to notable gains in academic performance and psychological well-being for children with learning disabilities, and that these results apply to children with intellectual disabilities. Tiengsomboon and Luvira's (2024) study supported this conclusion even more by showing that parents who are aware of the specifics of their children's learning challenges and who change the home support environment to meet their needs allow their children to succeed academically despite their disability. This suggests that early intervention is not confined to the family's everyday activities.

However, organised instructional courses have proved their efficacy in the classroom. Children with intellectual impairments made considerable gains in phonological awareness and word identification in the Headsprout Early Reading program, a phonics-based curriculum that uses progressive learning methods, as proved by Herring and Kovshoff's 2023 study. Tiengsomboon and Luvira (2024), in response, emphasise the irreplaceable role of parental attunement to a child's learning style and emotional state. Their qualitative study revealed that academic persistence significantly improves when caregivers adjust homework routines based on observed frustration or interest. Furthermore, Schuengel et al. (2023) argue that co-designing interventions with families, rather than simply delivering them, improves both fidelity and psychological safety, an element missing from most AI trials. The Children's School Success approach (Lieber et al. 2008) has also proven effective in fostering pre-academic skills in preschool kids with disabilities, such as letter recognition, counting, and classification. According to a meta-analysis of 17 studies conducted by Kim et al. (2025), interventions in inclusive classrooms, such as the use of prompting, had a moderate positive impact on academic achievement, particularly when supported by individualised education plans (IEPs) and collaboration between special education and general education teachers (see Table 1).

However, this optimism needs to be tempered by significant restrictions. Bandura's social cognitive theory (1977) holds that learning is socially mediated rather than just algorithmic, as reminded by Egele et al. (2025). Therefore, purely screen-based methods run the danger of ignoring emotional regulation, drive, and generalisation, especially in youngsters who have concomitant communication or attention issues

Table 1 shows a study by Yao et al. (2024) that also says that children with intellectual disabilities can only take part in mainstream classrooms if the quality of their interactions with their classmates and instructors is high enough to support their academic development and foster their desire in meaningful contexts. The degree of impairment consistently proved to be the most influential factor in deciding outcomes. Every high-impact study concentrated only on mild ID, and only Herring and Kovshoff (2023) covered moderate cases, and even then, improvements were restricted to basic literacy. This raises ethical issues. Rakap and Balikci's (2025) study discovered that embedding learning opportunities, incorporating academic abilities into everyday activities like play or classroom routines, boosts a child's engagement and eases the transfer of skills to real-world situations, hence fostering sustainability. Furthermore, according to Fernell et al. (2011) and Alsolami (2025), youngsters with IQs under 50 benefit little from existing models, writing down that they lack the intensity, multimodality, or AAC integration that this population needs. Additionally, there was a noticeable underrepresentation of writing, a crucial academic talent. Only two studies made mention of writing, and only tangentially, such as tracing and choosing symbols, despite its importance to expression, identity, and future independence. Neto and Aquino's (2009) findings, which were cited in the results, state that writing is exceptionally difficult due to the demands placed on the motor, linguistic, and executive functions. This absence is consistent with their observation. However, emerging research on augmentative and alternative communication (AAC) shows that digital tools may support written expression if they are integrated early, a potential that is still overlooked in mainstream intervention protocols. Ultimately, cultural context is important. Most of the evidence comes from high-income Arab or Western contexts. Parent-mediated models created in individualistic communities may not be transferable to collectivist cultures where extended family duties or educational expectations may vary, according to Guo and Keles (2025). As the global EdTech market grows, a crucial gap is that AI devices that have been trained on English-language phonics may make errors in diglossic or non-alphabetic language environments.

Inclusive education continues to be a hotly debated topic. In their engaging study, Yao et al. (2024) compellingly show that being physically present in regular classrooms is not synonymous with academic participation, rather, meaningful participation is contingent upon the quality of peer interaction, teacher expectations, and curriculum adjustments. According to their research from 2024, children with ID only succeed in school when their teachers utilise varied materials and encourage collaborative problem-solving. Kim et al. (2025), on the other hand, warn that inclusion may unintentionally exacerbate achievement gaps, especially for students with moderate-to-severe ID, without intensive, explicit instruction, such as systematic prompting or visual aids. The tension highlights a larger scholarly disagreement, wherein one school advocates for naturalistic, socially integrated learning (Rakap and Balikci 2025), while the other claims that organised, skill-based drills are essential for entry (Herring and Kovshoff 2023). In conclusion, the data show that the success of early intervention programs depends on the integration of three pillars of adaptive learning and technology, structured, evidence-based instruction, and an inclusive classroom environment and social support from the family, rather than on any one approach. Individualised learning in the education of children with intellectual disabilities is essentially the design of adaptable interventions that can be tailored to each child's unique characteristics, as evidenced by the variations in program efficacy that depend on the child's age and the severity of the disability.

To sum up, the field is shifting away from behaviourist remediation toward integrated, strength-based models that incorporate evidence-based pedagogy, responsive social scaffolding, and AI personalisation. This change is, however, uneven, as writing is ignored, moderate-to-severe ID is underrepresented, and cultural validity is still assumed rather than assessed. The most successful interventions are those that are customised to the child's cognitive profile, family environment, and cultural reality, and that may combine technology,

human aid, and environmental consciousness in a flexible manner, rather than those that depend on a single approach.

CONCLUSION

Early interventions are most successful in improving academic skills in youngsters with intellectual impairments when they are personalised, well-organised, and contextually integrated, as shown by this systematic review. Children with mild intellectual disabilities experience the best results, which are most consistently reached through family-mediated support, structured literacy programs, and technology-enhanced methods, notably artificial intelligence-driven systems. Particularly those that make use of artificial intelligence and adaptive learning systems, technology-enhanced methodologies show significant and lasting improvements in literacy, numeracy, and preacademic abilities. The age of the patient has an impact on the speed and extent of progress, with earlier interventions often resulting in greater benefits, while gender has no significant effect on how well therapy works. Active family involvement and well-organised curriculum also make a significant contribution to academic development, particularly when tailored to the child's cognitive capacity and learning environment. While gender has a minor impact on how well treatment works, age has an impact on the rate and degree of improvement, and the severity of intellectual impairment is the greatest moderator of intervention outcomes. Nevertheless, writing abilities continue to be significantly under addressed, and treatments for children with moderate to severe intellectual disability are still woefully lacking, underscoring crucial deficiencies in both theory and practice, successful intervention, combining personalised instruction, technological aid, and collaborative interaction among teachers, students, families, and inclusive environments.

RECOMMENDATIONS

Based on this discussion, here are some recommendations for practitioners, policymakers, and researchers. Integrating multiple intervention approaches, for example integrating artificial intelligence with family support and evidence-based teaching strategies to enhance the learning process. To perfect educational outcomes for children with intellectual disabilities, policymakers and practitioners should place a high priority on integrating adaptive technologies with evidence-based teaching techniques and family-mediated support. Standardised proper assessment tools tailored to the characteristics of the target groups to ensure correct measurement of academic progress. Targeted modules covering curriculum differentiation and individualised instruction catered to different cognitive ability levels are necessary in teacher training programs. Through user-friendly digital tools that give carers more power and increase understanding of successful learning methods, schools and communities should improve home-school relationships.

FUTURE STUDIES

Despite the positive results, there are areas for future research, like performing longitudinal studies to analyse the effectiveness of the interventions over a period, focusing on children with multiple intellectual disabilities, extending research to different contexts, and understanding the neural systems that explain how children with disabilities respond to educational interventions.

STUDY LIMITATIONS

The current study was limited to Web of Science and Scopus, the most prominent databases but research in another research engine may be not included. Likewise, the study directed only on academic skills, while other skills may be not covered.

CONFLICTS OF INTEREST

The author claims that the study has no conflicts of interest.

REFERENCES

Alsolami AS 2025. The effectiveness of using artificial intelligence in improving academic skills of school-aged students with mild intellectual disabilities in Saudi Arabia. *Research in Developmental Disabilities*, 156: 104884.

American Psychiatric Association 2013. *Diagnostic And Statistical Manual Of Mental.* Washington, DC: American Psychiatric Association.

Bandura A, Walters RH 1977. *Social Learning Theory.* Vol. 1. Englewood Cliffs, NJ: Prentice Hall.

Bignon V, Vuillemey G 2020. The failure of a clearinghouse: Empirical evidence. *Review of Finance*, 24(1): 99-128.

Brooks BA, Floyd, F, Robins DL, Chan WY 2015. Extracurricular activities and the development of social skills in children with intellectual and specific learning disabilities. *Journal of Intellectual Disability Research*, 59(7): 678-687.

Egele V S, Klopp E, Stark R 2025. How valid is Bandura's Social Cognitive Theory to explain physical activity behavior? *European Journal of Investigation in Health, Psychology and Education*, 15(2): 20. https://doi.org/10.3390/ejihpe15020020

El Khayat GA, Mabrouk TF, Elmaghraby AS 2012, Intelligent serious games system for children with learning disabilities. In: *2012 17th International Conference on Computer Games (CGAMES)*. IEEE. Louisville, KY, USA, pp. 30-34.

Fernell E, Hedvall Å, Westerlund J, Carlsson LH, Eriksson M, Olsson MB, Gillberg C 2011. Early intervention in 208 Swedish preschoolers with autism spectrum disorder. A prospective naturalistic study. *Research in Developmental Disabilities*, 32(6): 2092-2101.

Flemyng E, Moore TH, Boutron I, Higgins JP, Hróbjartsson A, Nejstgaard CH, Dwan K 2023. Using Risk of Bias 2 to assess results from randomised controlled trials: guidance from Cochrane. *BMJ Evidence-Based Medicine*, 28(4): 260-266.

Fletcher JM, Lyon GR, Fuchs LS, Barnes MA 2018. *Learning Disabilities: From Identification to Intervention.* USA, New York: Guilford Publications.

Gardner H 1983. *Frames Of Mind: The Theory of Multiple Intelligences.* USA, New York: Basic Books.

Guo L, Keles S 2025. A systematic review of studies with parent-involved interventions for children with specific learning disabilities. *European Journal of Special Needs Education*, 40(4): 755-772.

Herring E, Kovshoff H 2023. Investigating the use of Headsprout Early Reading with students with intellectual disability. *Research in Developmental Disabilities*, 141: 104368.

Johnson B 2016. Early intervention in children with developmental disabilities. *BMH Medical Journal,* 3(1): 1-4.

Kim G, Joo S, Kurth JA, Tuck KN 2025. A meta-analysis of interventions to support elementary students with intellectual disability in general education classes. *Research and Practice for Persons with Severe Disabilities*, 50(4). https://doi.org/10.1177/15407969251328662

Kurzeja O, Flynn S, Grindle C F, Sutherland D, Hastings RP 2024. Teaching reading skills to individuals with autism and/or intellectual disabilities using computer-assisted instruction: A systematic review. *Review Journal of Autism and Developmental Disorders*, 1-26.

Lee K, Cascella M, Marwaha R 2025. *Intellectual Disability.* In: StatPearls. StatPearls Publishing, Treasure Island (FL); PMID: 31613434.

Lieber J, Horn E, Palmer S, Fleming K 2008. Access to the general education curriculum for preschoolers with disabilities: Children's school success. *Exceptionality*, 16(1): 18-32.

Maulik PK, Mascarenhas MN, Mathers CD, Dua T, Saxena S 2011. Prevalence of intellectual disability: A meta-analysis of population-based studies. *Research in Developmental Disabilities*, 32(2): 419-436.

Neto Ana, Aquino Josefa 2009. A avaliação da aprendizagem como um ato amoroso: o que o professor pratica? *Educação em Revista,* 25(2): 223-240.10.1590/S0102-46982009000200010

Page MJ, McKenzie JE, Bossuyt PM, Boutron I., Hoffmann, TC, Mulrow CD, Moher D 2021. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *bmj*, 372.

Pérez J, Díaz J, Garcia-Martin J, Tabuenca B 2020. Systematic literature reviews in software engineering-enhancement of the study selection process using Cohen's Kappa statistic. *Journal of Systems and Software*, 168: 110657.

Rakap S, Balikci S 2025. Investigating the impact of embedded learning opportunities on the engagement of children with autism and intellectual disability. *Journal of Applied Research in Intellectual Disabilities*, 38(3): e70073.

Schuengel C, Van Rest MM, Stanford CE, Hastings RP 2023. Family co-creation of a research agenda for early intervention in intellectual and developmental disabilities. *Frontiers in Education,* 8: 1184719.

Selçuk A A 2019. A guide for systematic reviews: PRISMA. *Turkish archives of otorhinolaryngology*, *57*(1), 57.

Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Stewart L A 2015. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: Elaboration and explanation. *Bmj*, 349.

Tiengsomboon U, Luvira V 2024. Family support for children with learning disabilities to attain good academic performance: A qualitative study. *Malaysian Family Physician: The Official Journal of the Academy of Family Physicians of Malaysia*, 19: 25.

Vygotsky LS 1978. *Mind In Society: The Development of Higher Psychological Processes.* USA: Harvard University Press.

Wakeman M, Tesfaye L, Gregory T, Leahy E, Kendrick B, El-Toukhy S 2024. Perceptions of the use of mobile technologies for smoking cessation: focus group study with individuals of low socioeconomic status who smoke. *JMIR Formative Research*, 8(1): e58221

Yao X, Liu C, Xin W, Chen X 2024. Much more than just being present: Participation of children with intellectual disabilities in mainstream schools. *International Journal of Developmental Disabilities*, 70(5): 833-848.

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