Proceedings of the 5th International Conference on Education Innovation and Philosophical Inquiries
DOI: 10.54254/2753-7048/58/20241684

Early Interventions on Children with ASD: A Comprehensive Review

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Abstract: This study delves into the developmental outcomes and quality of life perspective in children with autism spectrum disorder (ASD) following early therapies. The study aims to unveil the efficacy of early interventions that target the myriad issues composing ASD through an exhaustive review of literature coupled with data analysis. It is identified that interventions have the capacity to mitigate basic impairments and nurture adaptive behavior: thus, fostering social interaction and communication, which are critical skills. In this study, the researcher establishes a framework for exploration based on various ethical considerations surrounding the issue and factors like technology and treatment methods that can enhance intervention effectiveness. They play a role not only in helping ASD children but also in their families, contributing towards positive outcomes for all involved parties. Interestingly enough, age along with hours spent studying show a significant correlation with test results — underlining the importance of academic engagement alongside developmental maturity indicated by these variables. In a related regression analysis: age and hours studied demonstrate positive relationships with test scores which in turn suggests that early interventions might lead to improvements in academic performance; an aspect worth consideration when devising intervention programs further down the line.

Keywords: Autism Spectrum Disorder (ASD), Children, Therapy, Early interventions; Family Intervention, Developmental outcomes

1. Introduction

Children with autism spectrum disorder (ASD) face difficult developmental obstacles that impact their behavior, social skills, and communication abilities. One of the most important strategies for addressing these issues and improving outcomes for kids with ASD is early intervention. The study question, hypothesis, and ethical considerations that guide the subsequent investigation of early therapies for ASD are presented in this introduction, which sets the scene.

1.1. Research Question

The central research question guiding this study is: How do early interventions impact the outcomes of children with autism spectrum disorder?

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DOI: 10.54254/2753-7048/58/20241684

1.2. Hypothesis

Building upon existing research and theoretical frameworks, the hypothesis of this study is formulated as follows:

Early interventions tailored to the specific needs of children with ASD will lead to significant improvements in their social interaction, communication skills, and behavioral outcomes compared to children who do not receive early interventions.

This hypothesis posits that targeted early interventions will yield positive outcomes for children with ASD, fostering greater adaptability, social engagement, and overall well-being.

1.3. Ethical Considerations

Research and practice in the area of autism spectrum disorder interventions are guided by ethical norms, which guarantee that families and children are the primary beneficiaries of these therapies. Important moral factors to think about are: Children with autism spectrum disorder (ASD) and their families have the right to make educated decisions about their treatment, and therapies should honor this right. Early therapies should aim to maximize benefits while limiting harms, promoting the overall welfare and development of children with ASD. This principle is known as beneficence. Prioritizing the safety and emotional well-being of children, non-maleficence means taking steps to ensure that interventions do not injure or distress them. Being culturally sensitive means being aware of and accommodating to the various cultural norms and practices held by people with autism spectrum disorder (ASD) and their communities.

The study's overarching goal is to protect the rights and dignity of families dealing with autism spectrum disorder (ASD) by incorporating these ethical concepts into early intervention research and practice. After the study topic, hypothesis, and ethical issues have been set up, the next chapters will examine the present knowledge, difficulties, and practice implications of early therapies for children with ASD through a thorough literature review.

2. Literature review

2.1. Research on the Importance of Early Interventions on Children with ASD

Early interventions in children with ASD is a topic that different scholars have studied for a long time. Research indicated that early intervention for children with ASD has tremendous importance in the improvement of children’s development and quality of life[1]. They found out that as a neurodevelopmental disorder, ASD is capable of affecting interaction, repetitive behaviors, and social communication among children. Equally, they found out that there is a need for the initiation of primary interventions before the age of three to ensure that children's outcomes are perfectly enhanced. According to research, there is a need to capitalize on the brain's plasticity during the early stages of development. [2] Capitalization is essential in the early stages of development. During this period, the brain is easily adaptable to interventions, and neural circuits are ready to learn and enhance social communication. They contended that the provision of structured interventions and support in the early phases of children's development promotes the development of essential skills for adaptive behavior, social interaction, and communication.

Likewise, Research found out that early intervention necessitates the identification of challenges and strengths of individual children, hence promoting the need for customized strategies, methodologies, techniques, and approaches to address each child’s specific needs. [3] The critical interventions identified by the authors include but are not limited to social skills training, occupational therapy, language therapy, and behavioral therapies. The interventions are crucial in targeting core deficits and addressing difficulties linked to motor coordination and sensory issues. Equally, research

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contends that early intervention plays a central role in the provision of invaluable guidance and support to the families of children with ASD and in the navigation to overcome the challenges linked with ASD in children. [4] Early intervention also offers resources to caregivers and parents to ensure proper child development and regular participation in daily chores. Early intervention equally plays a central role in mitigating secondary development challenges and delays in children. It addresses core deficits and reduces the severity linked with ASD difficulties like academic struggles, depression, and anxiety.

2.2. Studies on the Importance of Technology on implementation of Early Interventions on ASD in Children

A study focused on the role of technology in early intervention for children with ASD. [5] The authors contended that the utilization of modern technologies significantly enhances the accessibility and effectiveness of the interventions. Technology promotes customization and personalization by developing individualized interventions depending on each child's needs, tastes, and preferences. Digital platforms and software applications offer a more engaging learning experience since technological innovations can quickly adapt to the child's interests, learning styles, and skill levels. Equally, research [6] argued that technology through the utilization of communication aids and visual supports not only enhances the children's understanding but also promotes social cues and the expression of language. [6] It offers invaluable tools like augmented communication devices, picture exchange systems, and visual schedules that not only facilitate social interactions but also aid in the advancement of communication in children. Research found that technology plays an integral role in disseminating information to remote and underserved communities. [7] Telehealth platforms, for instance, promote the delivery of interventions, remote support, and conducting assessments by caregivers, educators, and therapists in real-time, thus not only overcoming geographical obstacles but also promoting easy reach to early interventions by the various stakeholders.

2.3. Studies on challenges associated with Implementation of Early Interventions for ASD

According to research, several challenges deter timely interventions and ASD identification[8]. The challenges affected not only the child's well-being but also developmental outcomes. Limited awareness is one such challenge. They found out that limited understanding amongst the healthcare experts, caregivers, and parents not only delayed early signs recognition but also led to delayed interventions. The other challenge that the authors identified is diagnostic delays. The authors noted that the ASD diagnostic phase is both time-consuming and complex, even though it involves an interdisciplinary approach of developmental specialists, psychologists, and healthcare professionals. The lack of enough diagnostic experts not only increases children's suffering but also overstretches on the available scarce resources. Similar research found that financial constraints and geographical barriers are also the key challenges in offering early interventions for ASD. [9] They found that early interventions were effective in urban areas as opposed to rural establishments. The rural establishments also needed more support resources, specialized care, and other necessary care, making access to diagnostic evaluations, support programs, and therapeutic interventions a nightmare. Equally, the study found that early interventions are not only costly in the long term but also need to be adequately covered by insurance packages. The fact that most of the ASD intervention programs are not covered in most insurance covers limits coverage to only wealthy families and limits specialized interventions, therapy sessions, and diagnostic assessments.

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2.4. Research on the Ramifications of failure to offer Early Interventions on ASD

Failure to offer early interventions for children with ASD also has significant ramifications not only on their well-being but also on their overall development. According to research, failure to offer early intervention measures for ASD promotes increased severity of ASD symptoms. [5] Without early interventions, children are likely to experience challenges linked to repetitive behaviors, communication challenges, and social interactions. Such challenges may not only be catastrophic but also problematic to address at a later stage of child development. Equally, children are likely to experience educational and academic difficulties that might affect educational attainment and academic progress. Failure to apply early interventions predisposes the children to challenges linked to adaptation to the environment, accomplishment of academic tasks, and peer interaction, ultimately resulting in in increased dropouts, decreased self-esteem, and educational underachievement. Likewise, research opine that failure to offer early interventions to children with ASD promotes emotional and social difficulties and family burdens. [10] Late interventions result in heightened emotional and social difficulties. According to the authors, the children may find it challenging to form friendships, regulate their emotions, and understand social rescue challenges, which, in turn, promote depression, increased loneliness, and anxiety, which affects their overall well-being and health. Late interventions also overstretch the families of the children with ASD. The authors noted that families that offered interventions late experienced helplessness, exhaustion, and increased frustration as they navigated to ensure their children developed in all aspects.

2.5. Studies on the Role of Ethics in ensuring the effectiveness of Implementation of Early Interventions on ASD

A study focused on the role of ethics in early interventions for ASD in children. [11] They discovered that ethics ensures that interventions respect children and their autonomy. The critical ethical principles identified by the authors are respect for autonomy, beneficence, and non-maleficence. The principle of beneficence calls for maximizing benefits to ensure children's well-being. Also, it stresses that early ASD interventions ought to be individualized, evidence-centered, and focused on enhancing the child's adaptive behaviors, social interaction, and communication skills. Also, the authors argued that early ASD Interventions ought not to harm the child but should prioritize children's safety and physical well-being. Equally, they called on the professionals to always consider the benefits and risks of interventions, as well as monitor adverse effects and strategies crucial for child comfort and safety. Research focused on three ethical principles and issues in early interventions in ASD; access, and equity, informed consent, and respect for cultural sensitivity.[2] They opined that early interventions should be accessible to all children regardless of their linguistic identities, cultural background, geographical location, and socioeconomic status. Equally, they argued that stakeholders should make efforts to ensure the reduction of disparities in access to ASD care and early interventions. Likewise, they argued that early ASD interventions should be culturally responsive and respectful of the children’s traditions, beliefs, values, and cultural backgrounds. They advised the professionals to partner with the children's families to understand better the children's priorities, preferences, and cultural perspectives. On top of that, they argued that professionals should inform parents about the nature of early interventions, the benefits, risks, and expected outcomes. [12]

2.6. Treatment Approaches, and Methods for ASD

A study [9] focused on the treatment approaches and methods for ASD. They found out that the treatment approaches and methods for ASD have several strategies that can curb not only the core symptoms but also the challenges of ASD. Also, they found out that the treatment methods can be developmental, therapeutic, educational, and behavioral. Applied Behavior Analysis (ABA), for

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instance, is a treatment approach that is personalized to break down tasks into manageable sub-tasks and provide positivity in desired traits. It is among the most utilized interventions in ASD treatment. Also, they discussed the role of the Early Start Denver Model (ESDM). They discovered that ESDM links ABA's principles to offer relationship and development-linked remedies. It stresses naturalistic teaching, positive interactions, and play-linked learning for cognitive development, language advancement, and social communication among children with ASD. A study focused on the role of speech-language therapy and occupational therapy. [6] They argued that the role of speech-language therapy is to improve alternative communication, pragmatics, language comprehension, and speech production. It offers alternative and cheap communication methods like augmentative and sign languages. They opined that occupational therapy (OT)addresses sensory regulation, motor skills, refined skills, motor coordination, and sensory processing hurdles. The Occupational therapy interventions promote the enhancement of the child's capability to participate in daily chores and improve the quality of well-being. According to research, a combination of the above methods and family involvement is crucial for the effectiveness of the treatment approaches. [13] It also calls for flexibility in the treatment plans to ensure that any emerging issues are considered and included in the treatment approaches.

2.7. Research on Importance of Early Interventions on Family and Wellbeing

A study focused on the importance of early interventions and family well-being. [10] The authors found out that even though early interventions in ASD target the child's developmental aspects, they also play an instrumental role in ensuring family well-being. Early interventions in ASD contribute to family well-being through education and empowerment. Early interventions promote educating and training caregivers and parents on ASD, strategies for child development, and its characteristics. Such knowledge encourages family empowerment since they better understand the child's needs and roles, hence better support and service delivery. Equally, research found that early interventions reduce anxiety and stress. [14] Early interventions alleviate anxiety and parental stress through the provision of support and guidance in the management of coping skills and challenging behaviors, thus increasing confidence in the management of child needs.

On top of that, similar research concluded that early interventions in ASD foster family dynamics. [6] They stressed the need to embrace family-centered care, ensuring communication and a positive relationship within the entire family setting. They pointed out that collaboration with the family strengthens family bonds and provides a ready and supportive environment for child upbringing and real-time decision-making on the most effective interventions for ASD. Likewise, early interventions aid in the advancement of the quality of care. They address the child's developmental gaps early, ensuring that interventions improve family functioning, independence, and social integration.

3. Data analysis

The data analysis employed in this study encompassed several statistical techniques, including descriptive statistics, correlation analysis, and multiple linear regression. These methods allowed for a comprehensive examination of the relationships between the variables under investigation.

3.1. Variables Used and their Level of Measurement

Age: This variable denotes the age of the study participants and is measured at the interval level. Age serves as a fundamental demographic characteristic that may influence various aspects of academic performance.

DOI: 10.54254/2753-7048/58/20241684

Hours of Study: This variable quantifies the number of hours participants dedicate to studying per week and is also measured at the interval level. It provides insights into participants' study habits and their potential impact on test scores.

Test Score: Reflecting participants' performance on a standardized test, this variable is measured at the interval level. Test scores serve as the primary outcome measure, indicating participants' academic achievement.

Extent of Early Interventions: This variable captures the level of involvement in early intervention programs and is measured on a scale of 1 to 20. Despite its ordinal nature, it provides valuable information regarding participants' engagement with interventions aimed at enhancing academic outcomes.

3.2. Descriptive statistics

Table 1: Descrptive statistics

Age	Average of Hours of Study	Average of Test Score
14	7.0	70.9
15	6.1	76.8
16	6.9	83.7
17	8.0	98.7
Average	**6.98**	**82.44**

The table illustrates the average hours of study and test scores for participants across different age groups. As age increases, there is a trend of higher average test scores, indicating a potential positive relationship between age and test performance. The distribution above can be graphed below (see Figure 1).

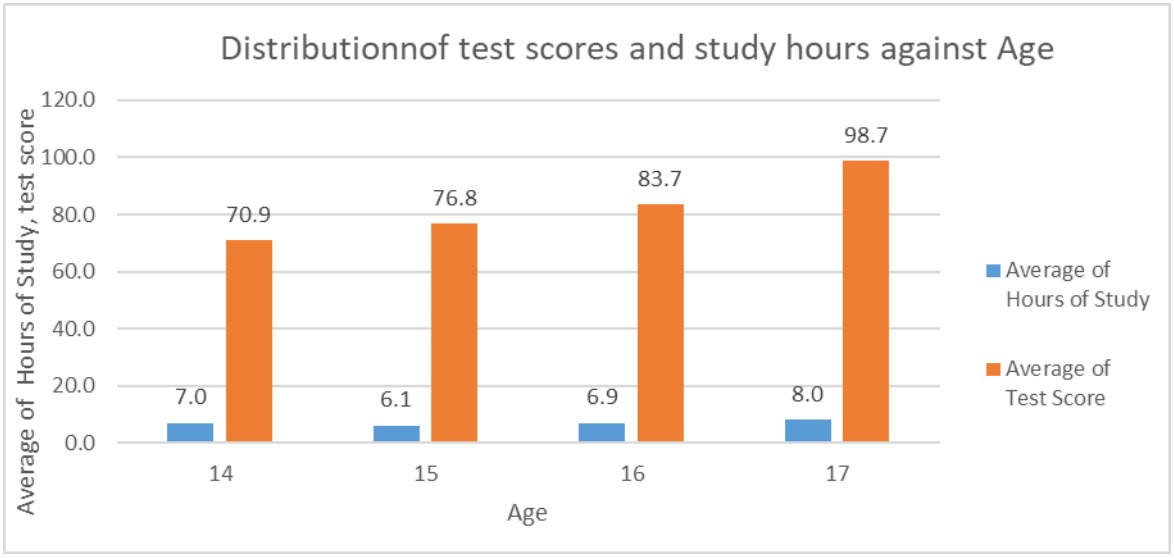

Figure 1: Distribution of test scores and study hours against age

The students with an average age of 14 years had the second longest study hours at 7 hours but recorded the lowest test score of 70.9 on average. The students with average age of 15 studied for 6.1hours on average and had a mean test score of 76.8. The students of 16 years of age had a mean test score of 83.7 having studied for 6.9 hours on average. The students who were 17 years of age had the longest study time of 8 hours and recorded the highest test scores of 98.7 on average.

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3.3. Regression analysis

Regression analysis explores relationships between variables. In this study, the dependent variable is the test score, while independent variables include age, hours of study, and extent of early interventions. The model aims to predict test scores based on these factors, providing insights into how age, study hours, and intervention participation influence academic performance.

3.4. Model output

The regression analysis reveals significant findings regarding the relationship between the dependent variable (test score) and the independent variables (age, hours of study, and extent of early interventions)(see Table 2).

Table 2: Model summary

Regression Statistics	
Multiple R	0.849998
R Square	0.722497
Adjusted R Square	0.704399
Standard Error	6.665327
Observations	50

The model demonstrates a strong overall fit, with a multiple R of 0.85 and an R-squared value of 0.72, indicating that 72% of the variability in test scores can be explained by the independent variables. The adjusted R-squared value further supports the model's robustness.

Table 3: Anova table

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	5320.697	1773.566	39.92126	7.38E-13
Residual	46	2043.623	44.42659		
Total	49	7364.32			

The ANOVA results indicate that the regression model is statistically significant ($F(3, 46) = 39.92$, $p < 0.001$), suggesting that at least one of the independent variables significantly predicts the test score.

Table 4 : regression coefficients table

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-55.7308	13.6301	-4.08881	0.000172	-83.1668	-28.2949	-83.1668	-28.2949
Age	6.223372	1.23637	5.033585	7.85E-06	3.734689	8.712055	3.734689	8.712055
Hours of Study	4.376944	1.688977	2.591477	0.012764	0.977211	7.776678	0.977211	7.776678
extent of early interventions	0.669718	0.327619	2.044197	0.046683	0.010255	1.329181	0.010255	1.329181

Examining the coefficients, age ($\beta = 6.22$, $p < 0.001$) and hours of study ($\beta = 4.38$, $p = 0.013$) show significant positive associations with test scores. Additionally, the extent of early interventions

DOI: 10.54254/2753-7048/58/20241684

demonstrates a marginally significant positive association ($\beta = 0.67$, $p = 0.047$), suggesting that greater participation in early interventions is associated with higher test scores.

4. Conclusion

This study shows that early interventions have a significant influence on children with an autism spectrum disorder. A comprehensive literature review and data analysis showed that early therapies improve ASD children's development and quality of life. The research question, hypothesis, and ethical issues provided a good foundation for investigating early therapies' effectiveness in addressing ASD's multifaceted problems. Data analysis showed substantial relationships between age, hours of study, early interventions, and test results. Academic engagement and development are crucial, as age and hours of study are significantly connected with test scores in the regression analysis. Early intervention programs may boost test scores, since their extent was slightly positively correlated with test results. This study adds to the expanding body of research on early interventions for children with ASD, revealing effective ways to enhance their development and well-being. Ethical considerations and evidence-based practices can be used to customize therapies to the different needs of children with ASD and their families, improving outcomes and quality of life.

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