

Effectiveness of the Early Start Denver Model for Children with Autism: A Narrative Review and Experiences for Viet Nam

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Abstract

Early intervention for children with autism is crucial for their development and quality of life. Different early intervention models exist, including the Early Start Denver Model, which has scientific evidence and is included in Vietnam's Guidance Document on Diagnosis and Intervention for Children with autism spectrum disorders. Therefore, quantitative research design and descriptive statistics methodologies are used in the study to review the Denver early intervention model's effectiveness in treating children with autism worldwide and bring lessons learned for application in Vietnam. This narrative review analyses 16 scientific articles conducted in an international database. Research results show that the Early Start Denver Model is efficacious in improving core defects in children with autism, such as social skills, communication skills, and repetitive behaviors, ...; using the Early Start Denver Model will improve parent-child interactions, reducing stress for parents during the parenting process. The findings also indicate lessons for applying the Early Start Denver Model for children with autism in Vietnam, considering factors like regional culture, educational facilities, and learning materials; motor skills and imitation skills should be combined with other therapies for better effectiveness.

Keywords: *ESDM, Early Intervention, Narrative Review, Autism.*

Introduction

Autism spectrum disorder is a neurodevelopmental disorder characterized by impairments in communication and social interaction, accompanied by restricted, repetitive, and stereotyped patterns of behavior and interest, and their sensory regulation is abnormal (Ministry of Health, 2022). In recent years, domestic and foreign studies have recorded a significant increase in the rate of children with autism (Hyman et al., 2020; Thanh et al., 2016). According to the global studies analysis, the overall prevalence of autism spectrum disorders is 1/132 (0.75%) (Baxter et al., 2015). The data from the US Centers for Disease Control and Prevention (CDC US) just released in early December 2021 shows that the rate of children with autism spectrum disorder among 8-year-old children in 2018 was 1/44, which is 2.3% (Maenner, 2021). In Vietnam, the University of Public Health conducted a study in 7 localities representing Vietnamese regions (2018), and the rate of autistic children aged 18-30 months was 0.75% (Hoang Van Minh et al., 2019). Autism spectrum disorder appears in early childhood, lasts long, and seriously affects the child's functional activities and the child and family's life quality. Therefore, it is necessary to start intervention as soon as possible when detecting difficulties or delays in children, ideally before age 3, to minimize the disorder's effects (Ministry of Health, 2022).

The importance of early intervention for children with autism has been proven in many different studies and is considered a clever investment. Early intervention brings progress for children but also increases the life quality of children and their families, helps children improve the necessary developmental skills to lead an independent life as much as possible, and reduces the costs of supporting and managing autistic children in the future. (Hyman et al., 2020; Zwaigenbaum et al., 2015; Nguyen Thi Hoang Yen, 2014). Thus, many different early intervention models are built for children with autism according to different intervention approaches, such as behavioral approach, developmental approach, comprehensive developmental approach, etc. The Early Start Denver Model (ESDM) is a comprehensive early developmental intervention

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of schools. It has been proven to be an early intervention model with scientific evidence for children with autism. The Guidelines for Diagnosis and Intervention of Children with Autism of the Ministry of Health (2022) suggests the ESDM model for children with autism in Vietnam.

ESDM is a natural and intensive early developmental behavioral intervention (Schreibman et al., 2015; Warren et al., 2011) specifically designed for young children from 12 months old up to 60 months old with or at risk of autism (Dawson & Rogers, 2010). ESDM is based on the Denver Model, a program developed for preschool-age children with ASD (Rogers et al., 1986; Rogers & Lewis, 1989). This approach was updated and officially guided for use in 2010 (Dawson & Rogers, 2010).

ESDM specifically targets imitation, nonverbal communication, verbal communication, joint attention, social skill development, and play skills, which are the main areas of deficiency in children with autism. This model uses essential response training techniques derived from applied behavior analysis (Dawson & Rogers, 2010), so the ESDM model also targets four areas, including motivation in the natural environment, responsive to multiple cues, self-managing and self-initiating (Koegel et al., 2006). The goals of the ESDM model are developmentally appropriate and designed to support positive and playful parent-child interactions and the development of meaningful social communication (Dawson & Rogers, 2010; Rogers et al., 2012). As a long-term goal, ESDM also focuses on skill generalization.

The ESDM model combines the teaching strategies of the three methods in intervention for children with autism. The teaching strategies of the ABA method include Attracting attention, antecedent-behavior-result principle, eliciting desired behavior, controlling results, gradually reducing the level of reminders, shaping behavior, behavioral sequencing, functional assessment, or behavioral analysis.

The Denver early intervention model has been applied in many developed countries worldwide and has been recognized for its comprehensive effectiveness and applicability in early intervention for children with autism. However, in Vietnam, there are only a few studies on the ESDM model of early intervention and the application of the Denver early intervention model in intervention for children with autism, as well as scientific evidence of its effectiveness on children with autism. Therefore, this article conducts an overview study on the effectiveness of the ESDM model for children with autism worldwide, thereby providing lessons learned when applying the ESDM model in early intervention for children with autism in Vietnam.

Method

Search Procedure

The literature review method is used to collect data for this study. Five electronic databases are used to find suitable documents related to the study topic: (i) Google Scholar search page (<https://scholar.google.com/>), (ii) Library Genesis (<https://libgen.is/>), (iii) Plos One (<https://journals.plos.org/plosone/>), (iv) Research Gate (<https://www.researchgate.net/>), (v) Sage Journal (<https://journals.sagepub.com/>). The English terms used were “children with autism”, “Denver model”, “ESDM model”, and “early intervention”; and Vietnamese terms used were "mô hình can thiệp sớm Denver", "mô hình ESDM", "can thiệp sớm", "trẻ tự kỷ". The timeframe for the studies to be considered was decided to be between 2010 and 2023 to review recent studies and to enlighten the increasing interest and up-to-date knowledge in the autism educational research field.

Inclusion and Exclusion Criteria

Inclusion criteria for each reviewed study: (a) only use the ESDM model to intervene for children with autism; (b) to be published between 2010-2023; (c) implement ESDM model directly on children with autism; (d) maintain the original criteria, indicators, and levels of the ESDM model; (e) to be published in a peer-reviewed journal; (d) to be written in English and Vietnamese; (e) to involve at least one participant with autism (without other difficulties). Therefore some papers were rejected based on the following

exclusion criteria: (a) they involved other early intervention models; (b) they were review papers, books, conference proceedings, or papers.

Reliability of Search Procedure and Inter-Rater Agreement

The two authors conducted the initial search and found 47 papers meeting the above inclusion criteria. Then, to obtain a certain degree of inter-observer reliability, both authors checked the 47 papers in full to confirm that the inclusion criteria were met. At this stage, 31 papers were rejected by both authors, bringing the total number of papers to be reviewed to 16. The inter-observer agreement between the two authors was 100%.

Findings

Table 1. Main Characteristics of 16 Studies on The ESDM Intervention Model Application

Authors/Year	Research object characteristics		Intervention process		Results
	Number (N)	Age (months)	Frequency	Implementer	
1. Dawson et al. (2010)	48	18 - 30	15 hours/week with therapists, 16 hours/week with parents, in 2 years	1 – 2 parent(s)/child, 1 therapist/child	Have a clear improvement in autism deficits.
2. Vismara et al. (2012)	9	16 - 38	1 hour/week in 12 weeks	1 parent/child	- Spontaneous and prompted functional speech, spontaneous imitation, attention, and social initiation increased significantly during the intervention - Receptive and expressive vocabulary (MCDI) increased significantly during the intervention. Adaptive behavior scores (VABS) also increased slightly
3. Eapen et al. (2013)	26	36 - 58	25 – 20 hours/week have group intervention, and 1 hour/week have personal intervention in 10 months.	The therapist specializes in implementing the ESDM model	Overall cognitive skills, receptive language, expressive language, and visual acuity increased during

					the intervention. Communication and gross motor skills increased significantly during the intervention, but overall adaptive behavior did not. There was a significant reduction in characteristic features of autism during the intervention.
4. Vivanti et al. (2013)	21	22 - 58	15 – 25 hours with group intervention/week in 1 year	The therapist specializes in implementing the ESDM model	Overall cognitive skills, including visual perception, fine motor skills, receptive language, and expressive language, improved after the intervention. There was no significant reduction in autism severity. More functional object use, goal understanding, and imitation were associated with excellent intervention benefits.
5. Vivanti et al. (2014)	57	< = 60	15 – 25 hours in 12 months	The therapist specializes in implementing the ESDM model	After intervention, the ESDM group had significantly higher cognitive ability and receptive language scores. There were no differences between groups in adaptive behavior or autism severity
6. Estes et al. (2015)	48	42 - 54	15 hours/week with the therapist, 16	Parents, therapists	Two years after the intervention,

			hours/week with parents in 2 years		the ESDM group had significantly higher adaptive behavior, including socialization. Children in the ESDM intervention group also had significantly lower overall severity of impairments caused by autism, including restricted and repetitive behaviors. There were no significant differences between groups regarding diagnostic classification, intellectual functioning, hyperactivity and irritability, and relationships with friends.
7. Ryberg (2015)	48	18 - 30	20 hours/week with the therapist, more than 5 hours/week with parents in 2 years	Parents, therapists	Data from this study demonstrated that participants treated with ESDM achieved significant gains in IQ, adaptive behavior, and autism diagnoses: communication, daily living skills, and motor skills.
8. Vivanti et al. (2016)	60	18 - 62	15 - 25 hours/week at the clinic, 2 hours/week at home in 1 year	Parents, therapists	Improved in language development, the importance of intervening at as early an age as possible for children with

					poor verbal language skills
9. Devescovi et al. (2016)	21	20 - 36	3 hours/week in 15 months	Parents, therapists	There are significant improvements in the areas of language and cognition. Regarding the severity of autism symptoms, there was a more remarkable improvement after ESDM intervention.
10. Touzet et al. (2017)	180	15 - 36	12 hours/week in 2 years	Professional therapist	There is improvement in language skills (non-verbal and verbal) and skills related to cognitive development
11. Wang (2019)	44	24 - 60	6 months	Professional therapist	There was significant improvement in the areas of language development, imitation, cognition, fine motor, and gross motor development
12. Geoffray et al. (2019)	19	30 - 48	12 hours/week in 10 months	Professional therapist	After ten months of intervention, significant improvements in verbal and nonverbal cognitive skills were achieved. The most considerable improvement was in the receptive language development index—promising results in adaptive daily behavior, with a slight

					improvement in communication.
13. Gao (2020)	70	24 - 60	3 months	1 group only had parents, 1 group only had 1 therapist	They have improved the relationship between parents and children, reduced psychological stress for parents, reduced autism severity, and reduced typical behaviors caused by the disorder in children.
14. Sinai-Gavrilov et al. (2020)	51	33 - 57	44 hours in more than 8 months	Parents	They improved cognitive abilities, expressive and receptive language, adaptive behavior, and social communication skills.
15. Tateno et al. (2021)	27	15 – 40	75 minutes/session/week in 13 months	Professional therapist	They reduced the severity of the decline in social skills and language delays, helping to minimize the severity of typical impairments caused by autism, such as eye contact and interaction with society, to a significant extent. Developmental areas such as adaptive behavior, cognition, and movement slightly improved.
16. Devescovi et al. (2023)	18	19 – 43	12 months	Professional therapist	Improvement in interaction and social communication skills, reduction in the severity of

					autism, and reduction in stereotypic behaviors
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The ESDM Model Develops Skills For Children With Autism Spectrum Disorders

12/16 studies are using the ESDM model in intervention for children with autism that have shown the effectiveness of developing receptive and expressive communication after intervention. All of these ten studies showed that after intervention, according to the ESDM model, both expressive and receptive communication skills of children with autism were improved. This is also the effectiveness proven in most studies on implementing intervention for children with autism through the ESDM model in the studies selected by the authors to include in the review. Research by Visrama and colleagues (2012) shows that during the intervention period, children's communication ability increased significantly, evidenced by three independent data sources: Children were stimulated in new languages, had meaningful and consistent with reality; language changes from passive and dependent on adult cues to spontaneous and independent speech appropriate to the context; Use rich interactive actions and gestures during play (Vismara et al., 2012). Especially with Vivanti et al.'s (2016) study, the research results show the importance of intervening at an early age as possible for children with poor expressive communication skills. In the study of Geoffrey and colleagues (2019), the index of improvement in skills in receptive communication was recorded as having the most significant improvement in all areas of development after the intervention, according to the ESDM model (Geoffrey et al., 2019). Thus, most of the intervention studies for children with autism through the ESDM model reviewed in the article have noted the effectiveness of receptive and expressive communication and also advised on implementing the intervention. The earlier intervention will be more effective for children with poor expressive communication skills. With research involving professional therapists and parents, children can apply communication skills in various real-life contexts, both in daily life and in the classroom and clinical environment.

There are 10/16 studies showing improvement in behavioral problems in children with autism through intervention according to the ESDM model. Studies show that children reduce the frequency of stereotypic and repetitive behaviors that affect their daily lives and learning abilities. At the same time, early intervention studies for children with autism through the ESDM model included in this review article also show that children's adaptive behaviors are significantly improved, helping children easily integrate and participate in daily living activities. The significant point is that in the studies showing the effectiveness of improving adaptive behavior in children with autism through intervention according to the ESDM model, up to half of the ten studies mentioned above showed the participation of children with autism parents. This proves that parents' contribution in coordinating interventions for children through the ESDM model will promote improved results of adaptive behavior problems in young children with autism.

There are 9/16 studies showing results on improving cognitive skills in children with autism. Of these nine studies, up to 5 significantly improved overall cognitive skills after intervention through the ESDM model.

There are 5/16 studies showing results on the development of motor abilities of children with autism after intervention through the ESDM model. The study of Eapen and colleagues (2013) showed that children's gross motor skills increased significantly during intervention. Vivanti and colleagues' (2013) study showed that children's fine motor skills improved after intervention with the ESDM model. Two studies show significant development of fine and gross motor abilities in children with autism after intervention with the ESDM model (Ryberg et al., 2015; Wang et al., 2019) However, the study of Tateno and colleagues (2021) also showed an improvement, but only a slight improvement in the motor area of children with autism. In summary, early intervention for children with autism through the ESDM model has shown improvement in the general motor area, but the results are unclear.

3/16 studies show that children with autism show results in the development of imitation skills in children with autism. In Vismara et al.'s (2012) study, children demonstrated the development of imitation skills in

fine motor skills activities with their parents (imitating the way their parents move when drawing), imitating their parents' words, and imitating their parents' words. In the study by Vivanti and colleagues, children with autism were measured for their ability to spontaneously imitate 8 simple actions on objects according to video observations, without having to rely on verbal instructions. The results showed a significant improvement in the skill of imitating different objects, thereby leading to children knowing how to use the functions of objects properly (Vivanti et al., 2013). In Wang et al.'s (2019) study, before and six months after the intervention, the experimental group's imitation ability was significantly higher than before the intervention and higher than the control group, showing that the intervention was modeled after the intervention. The ESDM model is more effective in improving the imitation ability of children with autism (Wang et al., 2019). Thus, through early intervention, according to the ESDM model for children with autism, children can improve their ability to imitate actions with objects, imitate fine and gross motor skills, and imitate the use of speech. However, this is not an outstanding result found in studies implementing interventions for children with autism through the ESDM model.

The ESDM Model Supports Parents

A study shows that the ESDM model not only improves children with autism difficulties but also positively affects parents and the relationship between parents and children (Gao,2020). This study has shown that when intervening for children with autism through the ESDM model, parents' stress in raising children is significantly reduced. At the same time, through intervention according to the ESDM model, parents improve their parenting skills, especially in approach, care, and education, establishing a parent-child relationship. Parents also master effective strategies for dealing with behavioral difficulties and core deficits caused by the disorder, thereby reducing pressure on the child's challenging aspects. Interaction disorders between parents and children are also reduced.

In summary, based on research reports, we see positive results in improving the core deficits of children with autism (communication, stereotypic, repetitive behavior) and other areas of development (cognition, movement, imitation). Among them, the number of studies providing results on improving the core defects of children with autism after intervention with the ESDM model accounts for the most. Imitation and motor skills differ from skills the ESDM early intervention model brings precise results. The ESDM intervention model with parental participation also helps reduce parental stress and improve parent-child interactions in families with children with autism. Thus, it can be seen that the ESDM intervention model has achieved the goal set by the author of this early intervention model: to support the improvement of core defects of children with autism, helping to reduce behavioral manifestations of the disorder. However, playing skills are also one of the goals that the ESDM model targets. None of the 16 studies we selected for inclusion in the descriptive review showed effective improvement in play skills for children.

Discussion

Research worldwide on implementing interventions for children with autism through the ESDM model has shown positive results in improving core deficits (stereotyped behavior, stereotyping, communication, social interaction) and several other skills (cognition, imitation, movement) while providing psychological support and improving interaction for parents and children. Thus, applying the ESDM early intervention model in intervention for children with autism spectrum disorder is appropriate and has scientific evidence.

Some important lessons are noted for the application of ESDM interventions in Vietnam in the future: At first, it is necessary to consider factors related to the development of Vietnamese children, factors related to regional culture, facilities at educational institutions, and necessary learning materials for intervention according to the ESDM model, thereby adjusting and applying the ESDM intervention model to suit early intervention for children with an autism spectrum disorder in Vietnamese conditions. In addition, with practical skills that have not been highlighted in publications on scientific evidence of applying the ESDM model in early intervention for children with autism, such as motor skills and imitation, it is necessary to apply them as well. Interventional approaches have scientific evidence for improving these skills and combining other therapies, such as physical and occupational therapy, to help improve these skills better.

Thirdly, the effectiveness of parents' contribution in coordinating interventions for children through the ESDM model will further promote the results of improving adaptive behavior problems in young children with autism. Educators and researchers also need to pay more attention to the intervention's duration, the intervention's subjects, and the intervention's location for children to be suitable for the child's field, which needs to be promoted and developed.

Conclusion

Through synthesizing the research results of 16 articles, it shows the positive effects of the ESDM early intervention model on children with autism spectrum disorder. After the intervention, according to the ESDM model, children with autism show clear progress not only in areas of child development such as communication, cognition, movement, and behavioral intervention but also help reduce the stress of parents, supporting positive interactions between parents and children when parents participate in the intervention process. Through the effectiveness that the ESDM model demonstrates on children with autism, we can see that this is an early intervention model with scientific evidence in improving core defects in children with autism as well as helping children with autism comprehensively cover other areas of development towards an independent life and improving integration ability for children with autism.

Suggestion

Because there are differences in regional and ethnic cultures in Vietnam, as well as the way intervention services at educational facilities are provided to children with autism, it is necessary to propose applied research directions to contribute. Researchers also need to verify the effectiveness of the ESDM model in intervention for children with autism spectrum disorder in Vietnam in future research.

Limitation

This study conducts a descriptive overview of studies applying the ESDM model on very few children with autism spectrum disorders in Asia (only 1 study), so we rarely have enough lessons about adjusting the ESDM model to fit the Vietnamese culture more. In addition, the characteristics of children with autism spectrum disorders who have experimentally applied the ESDM model in the compiled studies are not diverse in terms of age and disorder characteristics.

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