INFLUENCE OF INDIVIDUAL DIFFERENCES AND DEVELOPMENTAL TRAJECTORIES OF CHILDREN WITH AUTISM ON THE OUTCOMES OF MUSIC AND MOVEMENT INTERVENTION

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Autism spectrum disorder (ASD) is a group of complex neurodevelopment disorders that lead to individuals' deficiencies in social interaction, social communication, and restricted and repetitive behaviors. Individuals with ASD may experience different levels of symptoms, severity, and comorbidity, depending on their individual differences, developmental trajectories, and other biological conditions. The purpose of this study was to examine the influence of individual differences and developmental trajectories on the effectiveness of music and movement intervention in improving the sensorimotor and socio-emotional development of children with ASD. A multiple case study research method was applied to collect qualitative data throughout the six-week study using semi-structured interviews with parents, interventionist's lesson plans and personal journals, observation notes, and video recordings. The four participants who had a different range of autistic symptoms and severity were chosen through purposive sampling to examine how their individual differences affected their responses to the music and movement intervention. The findings indicated that the music and movement intervention outcomes on each participant's sensorimotor and socio-emotional development depended significantly on their individual differences in responding to the treatment effects. Consequently, researchers who plan for their early intervention treatment programme for children with autism should consider the children's individual differences to adjust and refine their treatment plans to suit the children's developmental needs.

Keywords: Autism spectrum disorder, developmental trajectories, individual differences, sensorimotor, socio-emotional development

INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that affects individuals' social interaction, social communication, and repetitive and stereotyped behaviours. The Simonoff et al. (2019) study indicated that individuals with autism might experience different degrees of severity and symptoms as they grow, depending on their environment and exposure during their developmental stages. The severity and developmental trajectories of these individuals with ASD rely on their individual differences and their training during their childhood. Researchers also argue that early diagnosis and early intervention are crucial for children with ASD to improve their overall development and achieve positive outcomes (Corsello, 2005; Pasco, 2018). Currently limited studies have examined the influence of individual differences and developmental trajectories on the effectiveness of music and movement intervention in improving the sensorimotor and socio-emotional development of children with ASD. Thus, this study aimed at examining the effects of individual differences and developmental trajectories of four children with ASD in influencing their socio-emotional and sensorimotor responses during the music and movement intervention. The findings of this study provide knowledge on factors influencing intervention effectiveness for researchers interested in examining therapeutic effects of music and movement intervention for children with ASD.

Children with ASD often find themselves having difficulties in interacting and building relationship with other people, reading and understanding social cues, interpreting gestures and facial expressions, theory of mind, regulating emotions, communicating verbally or non-verbally, controlling their repetitive behaviours, and adapting or adjusting themselves to a wide range of activities (Bekele et al., 2013; Jellema et al., 2009; Leekam, 2016). Hannaford (2005) suggested it was crucial to understand the correlation between sensorimotor, social interaction, social cognition, emotional development, and mind-body integration. Pusponegoro et al. (2016) found that children with ASD who had lower gross motor skills exhibited more deficiencies in their social skills than those without gross motor skill deficits. Besides, a few researchers also argued that the motor impairments among children with ASD should be examined during the preliminary stage of diagnosis for autism. Those autistic individuals who have difficulties in incorporating sensory inputs into the planning and execution of movements tend to have lower social and communication skills and weaker emotional development (Hannant et al., 2016; Mosconi & Sweeney 2015).

Music and movement intervention is one of the approaches in music therapy that emphasises incorporating body movements to express musical expression and musical entrainment. Chorna et al. (2019) argued that application of music as an early intervention tool could stimulate and develop an individual's multisensory system and also rebuild neural connections. When individuals listen to music, their auditory cortex will be activated and start working with the frontal-temporal, parietal, and subcortical areas related to attention, motor

skills, and memory (Nelken, 2011). Activation of the auditory-motor system plays a crucial role in reconnecting the brain functions and improving the social communication of children with ASD (Wan et al., 2011).

The therapeutic effects of auditory-motor interaction in music perception and production for children with ASD lie in the concept of rhythmic entrainment that promotes the synchronization between rhythmic bodily movement and acoustic stimuli (Chen et al., 2008; Tryfon et al. 2017). Individuals with ASD may respond differently to music and movement intervention depending on the abilities to perceive, understand, process, and execute the information that they gather during the music and movement activities. Thus, it is crucial to understand the individual differences among the children with ASD to choose a suitable curriculum and teaching method to help them progress beyond their symptoms and disabilities (Trembath & Vivanti, 2013). Zachor and Ben-Itzchak (2017) also suggested that the effectiveness of an early intervention for children with ASD depended on individual variables such as autism severity, cognitive ability, and adaptive behaviour skills. An early intervention such as the music and movement approach needs to be constantly evaluated and modified to meet the individual needs and development of children with ASD to realise the best treatment results.

PURPOSE OF THE STUDY

This study focused on exploring the influence of individual differences and developmental trajectories in affecting the effectiveness of music and movement intervention on enhancing the sensorimotor and socio-emotional development of children with ASD. The purpose was to investigate the therapeutic outcomes of music and movement intervention on four participants with ASD, influenced by each participant's individual differences in autistic traits and developmental trajectories.

METHODOLOGY

Research Design

This study applied a multiple case study approach on three children and one adolescent with ASD aged between four and fourteen. This multiple case study applied purposive sampling in selecting the four participants with different symptoms, severity, and comorbidities. This study lasted for six weeks on a one-on-one basis. The research tools used for the qualitative data collection in this study included semi-structured interviews with parents before and after intervention, interventionist's personal journals and lesson plans, observation notes, and video recordings.

Stake (2006) suggested that a multiple case study allowed researchers to examine various cases with their specific problems, yet they were related to each

other in certain aspects. We applied a multiple case study approach to examine how the four participants with autism's individual differences and developmental trajectories affected music and movement intervention's effectiveness on their sensorimotor and socio-emotional development. In the meantime, we also tried to build a linkage between the four cases using the same teaching methods based on the concepts of rhythmic and musical entrainment, included singing, body movements, call-and-response songs, fingerplays, and instrumental playing throughout the six-week music and movement intervention.

Sampling Method

ASD is a spectrum neurodevelopmental disorder in which individuals have their unique autistic characteristics affected by their severity, symptoms, and comorbidities. We found it challenging to select participants with similar autistic traits and cognitive abilities to participate in this study. Thus, the sample selection criteria were limited to participants' autistic characteristics and parents' willingness to work with the interventionist in the data collection process. Merriam (1998) suggested that purposive sampling was an effective sampling strategy when the researchers wanted to discover, understand and gain insights on the characteristics of a sample that was assumed to represent the population. The purposive sampling allowed us to purposefully choose participants who had heterogeneous autistic traits to investigate and understand the influence of individual differences and developmental trajectories of each participant with ASD in response to the therapeutic effects of music and movement intervention.

We recruited the four participants with different severity and symptoms of autism from a local child development centre located in Kuala Lumpur that offered other therapeutic programmes to children with neurodevelopmental disorders. Although notice of recruitment was announced on social media one month before the study, there was no responses after two weeks of announcement. Consequently, the participants' selection focused on recruiting children with ASD who were attending therapies at the local child development centre.

Participants

Participants of the study included three children and one teenager with ASD. They had different levels of autistic severity, symptoms, comorbidities, and sensorimotor deficits. The participants were identified as Participant Male A, Participant Male B, Participant Male C, and Participant Female D in this study for confidential purposes. The data on the symptoms, medical conditions, behaviours, sensory issues, cognitive abilities, sensorimotor and socio-emotional development of the four participants were obtained from their parents during the one-hour pre-intervention semi-structured interviews. Based on the data collected from the pre-intervention semi-structured interview, a summary of each participant's individual differences and developmental trajectories is presented in Table 1.

Table 1
Summary of Participants' Individual Differences and Developmental Trajectories

Individual Differences and Developmental Trajectories	Participant Male A (4-year-4-month)	Participant Male B (5-year-4-month)	Participant Male C (5-year-6-month)	Participant Female D (14-year-9-month)
Severity Comorbidities	• Severe • Hypoactive • Hypotonia	• Mild • Hypotonia • Hyper-mobile and hyperflexible joints	• Mild • Hypotonia • Anxiety disorder	• Severe • Hypotonia • Nystagmus • Sleep disorder • Intellectual disability
Sensorimotor	• Poor fine and gross motor skills • Auditory processing disorder	• Poor balance • Unsynchro-nised limb movements • Poor visual-motor integration • Auditory processing disorder	• Poor balance • Poor fine and gross motor skills	• Severe motor dysfunctions • Poor postures and body movements • Auditory processing disorder
Socio-emotional functions	• Throw tantrum when needs were not met • Strong attachment to mother • Poor self-regulation • Poor eye contact	• Interested in socialising • Threw tantrum when intentions were not understood • Poor eye contact	• Became anxious easily in a new environment • Short attention span and poor memory	• Bit her thumbs when frustrated or upset • Poor eye contact
Speech and communication	• Uttered around 10 single words • Minimum two-way verbal and non-verbal communi-cation.	• Unclear speech • Managed to say about 30 single words • Had problems articulating his speech.	• Said more than 30 single words • Problems in articulating words with letters "s" and "f"	• Non-verbal. She relied mainly on non-verbal communica-tion

Data Collection Tools

Data were collected using qualitative research tools that included pre- and post-intervention semi-structured interviews, interventionist's lesson plans and personal journals, observation notes, and video recordings. Triangulation was applied to minimise biases by obtaining data from several research methodologies to explain the same phenomenon.

Parents of the four participants were asked to complete the semi-structured interviews before and after the six-week music and movement intervention. Each interview lasted for about one hour by phone for the convenience of the parents. We recorded each interview to prepare for the transcripts. As the four participants' parents spoke in Mandarin or Cantonese during the interviews, the transcripts needed to be translated into English. The recorded interviews were important for checking and verifying the accuracy of the translations. The pre-intervention interview focused mainly on obtaining information on the four participants with ASD's medical and health histories, socio-emotional and sensorimotor abilities, past and current therapies, and weaknesses and strengths in cognition. On the other hand, another semi-structured interview was conducted at the end of the intervention to gather information on parents' observations of their children's socio-emotional and sensorimotor responses to the music and movement intervention and their suggestions on how to improve the effectiveness of the intervention.

The interventionist kept track of her reflections on each participant's emotional responses, verbal and non-verbal communications, motor functionality, and social interaction using personal journals. These reflections were critical for the interventionist to review her lesson plans according to each participant's progress with ASD during the six-week treatment period. While preparing for her personal journals, the interventionist could refer to each lesson's video recordings for further reference and verifications. On the other hand, the three independent observers also used the video recordings to prepare their observation notes of the first, third, and sixth lessons focusing on the participants' socio-emotional, motor, and sensory responses to the music and movement intervention.

Research Procedures

One week before the study started, we conducted the pre-intervention semi-structured interviews with the parents to obtain more information on the recruited participants' socio-emotional and sensorimotor development. Besides, other qualitative data were also collected through observation notes, interventionist's lesson plans and personal journals, and video recordings.

Each of the participants had to attend six weeks of music and movement sessions, with each session lasting for half an hour on a one-on-one basis. Participant Male A's mother requested to join her son during the treatment sessions as she argued that he was too young to be left alone with the

interventionist. In the meantime, the other three participants attended the treatment sessions without any parental accompaniment. A total of 20 children's songs were pre-selected for this study. During the study period, the interventionist modified some of the song's presentation approaches to accommodate the participants' motor and socio-emotional progress.

The interventionist prepared a personal journal after each lesson, writing down reflective notes on her observation during the lesson and each participant's reactions to her treatments. Each class was video recorded for future reference by the interventionist and the three independent music and movement researchers while preparing their observation notes. The three independent researchers had to refer to the video recordings when they prepared for their observations on the first, third, and sixth lessons. The observers were unable to do any field visits due to their daily busy work schedule. This study's researchers also opined that the independent researchers' presence during lessons might affect the participants' responses and concentration. Parents had to go through the post-intervention semi-structured interviews by phone to obtain their feedback and suggestions on the effectiveness of music and movement intervention for their children. All the collected qualitative data were then analysed using inductive coding, and the results were reported in a descriptive format.

Data Analysis

The qualitative data collected from the semi-structured interviews, lesson plans, personal journals, observation notes, and video recordings were analysed using inductive coding, allowing the construction of themes, coding, and annotations to arise from raw data. The collected qualitative data analysis started with two prior themes on participants' motor skills and socio-emotional functions. However, after coding and recoding, another theme emerged as the researchers of this study found that the individual differences and developmental trajectory could also be affected by participants' sensory sensitivities. As a result, the final coding of this study was explored from the aspects of sensory sensitivities (visual-motor processing, auditory-motor processing, auditory processing, tactile, proprioception, and vestibular), motor skills (motor synchronisation, motor coordination, motor control, and motor planning), and socio-emotional functions (restricted and repetitive behaviours, self-regulation, self-expression, and joint attention).

RESULTS

Although all four participants managed to complete their six weekly music and movement inventions in this study, some post-intervention data was missing due to some unforeseen circumstances. For example, as Participant Male C's

mother gave birth to a baby three days after Participant Male C completed his treatment sessions, his mother did not have the time to complete the post-intervention semi-structured interview. As a result, the descriptive report on Participant Male C's development and progress had to rely on the interventionist's personal journals and observation notes for further analysis. The observation notes prepared by the three independent observers were based on their observations of the first, third, and sixth lessons from the video recordings. Although the video recordings allowed the observers to analyse the treatment sessions respectively, they might miss out on some of the detailed nuances, such as the participants' facial expressions and non-verbal cues. The only one video camera placed in the room could not capture all activities' details from different angles, which could affect the quality of observation data. The observation notes' data needed to be checked against other data collected from the semi-structured interviews and personal journal for cross-coding purposes. This study's outcomes were presented in a descriptive format, recording each participant's individual responses to the music and movement treatments and participants' development and progress throughout the research period.

The qualitative data collected from the parents' pre- and post-intervention semi-structured interviews, interventionist's lesson plans and personal journals, observation notes, and video recordings were used to answer two main research questions: (a) the influence of individual differences on the sensorimotor development of participants with ASD; and (b) the influence of individual differences on the socio-emotional development of participants with ASD.

Influence of Individual Differences on the Sensorimotor Development of Participants with ASD

Trembath and Vivanti (2013) suggested that individual differences should become the top agenda in research on ASD, considering that individuals with ASD who had their unique spectrum of symptoms and severity responded differently to a treatment. The developmental trajectories of each participant's sensorimotor function also depended on their individual differences. This study's findings indicated that the four participants with ASD's motor development during the six-week study depended distinctively to their motor functions and cognitive abilities. Participant Female D who had the poorest sensorimotor among the four participants needed a lot of "physical guidance" as Observer 1 mentioned in her video observation on Participant Female D's third lesson that:

> *During the "Up and Down" song, the interventionist guided her with a tambourine, providing visual stimulations to execute the up and down movements.*

Participant Female D's severe impairments in her motor planning and coordination had hindered her progress in her sensorimotor development at the

end of the study. Her mother reflected in her post-intervention interview that she "could not see any significant improvement" in her daughter's sensorimotor development. Nevertheless, the data collected from the interventionist's personal journals and observation notes indicated that even though Participant Female D's improvement on her sensorimotor functions was not too noticeable, but she needed less guidance from the interventionist in executing some of the given activities' movements as the treatment progressed into the sixth week. Observer 2 commented in her observation note on Participant Female D's sixth lesson that:

> *She was able to shake the bell sticks with the right hand without the teacher's assistant in the 'Hokey Pokey' song, but she continued to have problems in doing so with her left hand.*

During the post-intervention interviews, the parents of Participant Male B and Participant Male C noted significant improvement in both participants' socio-emotional and sensorimotor development by the end of the music and movement intervention. Nevertheless, the participants continued to have sensorimotor issues such as balancing, visual-motor integration, motor coordination, and physical endurance. The video transcripts suggested that Participant Male B faced challenges in balancing himself in a sitting position when he concentrated too much on figuring out how to execute specific unfamiliar movements. Observer 1 also noted in her observation of Participant Male C's sixth lesson that:

> *Participant Male C had problems coordinating his hands and legs when he marched. He found it difficult to synchronise his hand and legs when he marched. ... The egg shaker flew out of his grip when he shook it with exaggerated hand movements on several occasions.*

On the other hand, Observer 2 pointed out that Participant Male C showed some fine motor skill improvements. She commended in her observation of his sixth lesson that "Participant Male C improved significantly on his fine motor skills, as shown in his 'creeping' finger movement in the 'Open and Shut' song."

Observer 1 commented on Participant Male B's sensorimotor development during his third lesson that:

> *when he tried to raise his hands above his head in the 'Twinkle, Twinkle Little Stars' song, he fell to the side in his sitting position... . He seemed to have problems in identifying his fingers in the 'Finger Family' song."*

However, by the sixth lesson, the interventionist noted that Participant Male B was able to execute all the actions in the 'Baby Shark' song even though he could not move in time. Nevertheless, the video transcripts captured an exciting

point on Participant Male B's sensorimotor functions in which his limb movements could occasionally trigger itchiness on his nose and eyes. The music and movement intervention did not seem to help him overcome this awkward sensorimotor issue.

Observer 2 noted that even though Participant Male A needed much guidance from the interventionist and his mother in completing his tasks in his first lesson, he was able to complete some of the tasks himself by the sixth lesson. For example, he could tap consistently on beats on the tambourine in the 'Star Wars' song, and he seemed to enjoy it during the treatment session. The interventionist also reflected in her personal journal that:

> *Participant Male A was willing to try out some activities such as marching, turning around, and squatting down by himself more during the sixth lesson. Jumping and running were still somehow challenging for him at this stage. However, he started to play the tambourine, handbells, bell sticks, and egg shaker by himself.*

All the data obtained through triangulation confirmed that Participant Male A faced challenges in executing movement in most activities. It was difficult to judge whether his neurodevelopment or psychological barrier caused these sensorimotor weaknesses. Participant Male A refused to follow the interventionist's instructions at the initial stage of treatment and depended on his mother to lead him in the movement execution. Interestingly, when he was occasionally left alone to play on a musical instrument, he could play onbeat.

The Influence of Individual Differences on the Socio-emotional Development of Participants with ASD

Studies indicate a close relationship between sensorimotor deficits and socio-emotional deficiencies among individuals with autism (Mosconi & Sweeney, 2015; Stevenson et al., 2017). Participant Male A and Participant Female D, who had weaker sensorimotor skills than Participant Male B and Participant Male C, tended to have more emotional disturbance during the music and movement intervention. For example, the interventionist reflected in her fifth lesson personal journal that:

> *Participant Male A already showed tantrums when he came into the room. He cried for almost thirty minutes before I could start the class. He still could not calm himself down during the lesson.*

The video transcripts also suggested that Participant Male A started to get frustrated when she failed to calm him down. Morris and her colleagues (2007) posited children's emotional regulation could be influenced by the family's emotional climate via parenting style, attachment relationship, family

expressiveness, and marital relationship. In this study, Participant Male A's parental influence on his development was apparent. Participant Male A had a strong attachment to the mother. His mother refused to let go, allowing Participant Male A to learn independently. Before the study started, Participant Male A's mother requested to stay with her son as she reasoned that "My son is too young to attend the class by himself, and he needs my help."

Similarly, the pre-intervention interview transcript also suggested that the mother was very protective of Participant Female D as she mentioned that "she would throw things when she was angry." Participant Female D's mother mentioned in her post-intervention interview that she could not see any significant improvement in her socio-emotional development. The parent commented that:

> *I can see that my daughter enjoyed the lessons. She gets excited when music is on. However, she still cannot make eye contact with us. ...She continues to flap her hands when she gets excited. ...Her mood swings still happen quite often.*

However, the observers' observation notes and the interventionist's personal journals indicated that Participant Female D showed some improvement in her socio-emotional skills during the study period. The interventionist commented in her final personal reflection on Participant Female D that "Participant Female D became more stable emotionally by the end of the sixth lesson than when she started the study." This conflict of perceptions on the progress of Participant Female D's socio-emotional development could result from the mother's expectation that was not aligned with the treatment goals. According to the interventionist, the mother had never followed up on what Participant Female D learned during the study period.

Participant Female D got distracted easily by external sounds and shining things such as the bells during lessons during the six-week intervention. The interventionist commented in her final personal report that:

> *Participant Female D loved playing with the tambourine, handbells, and bell sticks as these instruments have shining bells. She loved to hold the instruments and rubbed her fingers against the shining bells. ... Participant Female D showed improvement in her attention span as the lessons progressed, even though she still liked to look around most of the time as a means of regulating herself when she was overstimulated.*

Although Participant Male C showed the most engagement and enjoyed himself during the music and movement activities compared to others, his weak physical endurance often affected his concentration as noted by Observer 1 in his sixth lesson:

> *Participant Male C started to lose his concentration in the 'Little Red Caboose' song. Instead of holding the handbells properly in his hands, he started to play absent-mindedly with the instrument.*

The video transcript also suggested that Participant Male C had a "short span of joint attention" and "became anxious easily when introduced to new activities." One way for Participant Male C to regulate himself was to smell the instruments he was holding. He would smell the musical instruments when he was overwhelmed with stimulations and started to lose his concentration. For example, towards the end of the sixth lesson, Observer 1 pointed out that:

> *Instead of playing on the resonator bars, Participant Male C smelled the mallets. He had problems following the rhythm, and he kept missing his aims on the instrument.*

The interventionist was satisfied with the progress of Participant Male C by the end of the study as she commented that:

> *Participant Male C was able to control his emotion well and stayed positive while working with the given tasks. He enjoyed music very much and sometimes he would request me to turn on certain music that he liked.*

On the other hand, Participant Male B also had his way of regulating himself when he was overstimulated. He liked to go to the video camera to look at the screen or went to the bean bag at the corner of the room to play with the soft tiger toy. The interventionist commented on her reflective note that "Participant Male B had to go to the bean bag and video camera after one activity before going to the next activity." The mother of Participant Male B provided positive feedback on the improvement of his socio-emotional skills during the post-intervention interview, saying that:

> *He is now more willing to express himself verbally and also to have a two-way communication. He can control his emotion, and he can convey his needs verbally to us even though his speech is still not clear.*

The interventionist also commented that Participant Male B was "more willing to communicate" with her even though "his verbal communication was limited to a few single words."

In sum, the results indicated that the four participants with ASD responded differently to the treatment of music and movement intervention due to their autistic severity, comorbidities, and symptoms. Each participant showed

a different level of improvement in their sensorimotor and socio-emotional development during the study period. The findings suggested that Participant Male A and Participant Female D, who had weaker physical skills than the other two participants, faced more self-regulation difficulties, self-expression, joint attention, and adaptation to new activities or environment. This outcome suggested there was an association between the sensorimotor difficulties and socio-emotional deficiencies among individuals with autism.

Participant Male B and Participant Male C, who loved music, were motivated to work diligently to attain self-satisfaction and self-fulfilment throughout the study period. Both participants also worked hard to overcome their socio-emotional and motor coordination weaknesses. Although Participant Male B and Participant Male C continued to have some difficulties in their motor coordination and motor planning, the rhythmic stimuli embedded within the music and movement curriculum encourage them to make the necessary adjustments to their body movements to move along with the music. Schuetze et al. (2019) suggested that individuals with ASD had the same motivation to learn as other typically developing adolescents if they were allowed to learn according to their interests. As a result, Participant Male B and Participant Male C showed significant improvement in their socio-emotional and sensorimotor development after the six-week study.

Although Participant Female D enjoyed music as much as Participant Male B and Participant Male C, her severe sensorimotor and social impairments had affected her progress in the music and movement intervention. It was challenging for Participant Female D to realise the therapeutic effects of rhythmic entrainment embedded within the music and movement activities without some fundamental physical abilities. On the other hand, the case study on Participant Male A was unique compared to the other participants. The study outcomes could not reflect well on how much individual differences had affected his sensorimotor and socio-emotional development during the six-week study period with his mother's interference in the treatment procedures. Communication breakdowns and vagueness in shared goals between the interventionist and Participant Male A's parent could be a setback for his learning experience. In this case, Participant Male A's progress in the music and movement intervention depended more on his developmental trajectories. Morris et al. (2007) suggested that children learned emotional regulation through observing, modelling, and referencing to their parents' emotion and emotion management. Participant Male A, who depended on his mother to help him complete his daily tasks, had not been putting enough effort into developing his socio-emotional and sensorimotor functions. He tended to throw tantrums when his needs were not met and quickly gave up when he was given challenging tasks. His development trajectories, especially in family relationships, significantly influenced his learning motivation. He needed guidance from various parties included the interventionist and his family members throughout his learning process.

DISCUSSION

The multiple case study research design allowed this study's researchers to examine each participant's influence with ASD's individual differences and developmental trajectories on their sensorimotor and socio-emotional responses to the treatment of music and movement intervention. This study's results confirmed Trembath and Vivanti's (2013) earlier findings that an understanding of children with ASD's individual differences on treatments was crucial to match these children to the best-suited treatment for long-term benefits. In this study, Participant Male A and Participant Female D did not significantly improve their sensorimotor and socio-emotional development compared to the Participant Male B and Participant Male C. The Participant Male A's and Participant Female D's severity, symptoms, comorbidities, and cognitive abilities could have negatively affected their responses to the music and movement intervention. However, Vivanti et al. (2014) pointed out in their study that current theoretical and methodological approaches had their limitation in predicting the treatment outcomes among individuals with ASD. The short study period of six weeks also had its limitation in seeing significant improvements in Participant Male A and Participant Female D, especially when both had severe sensorimotor deficiencies and poor socio-emotional development. Linstead et al. (2017) suggested that the treatment intensity and duration could predict learning and mastering outcomes in individuals with ASD.

During the data analysis process, the researchers found that family relationships played a vital role in the participants' sensorimotor and socio-emotional development during the music and movement intervention. When parents are over-protective of their children with ASD, their children will not gain much from the therapies they are undergoing, as shown by Participant Male A's treatment outcomes. Karst and Van Hecke (2012) pointed out that a negative parent and family relationship could diminish positive effects of an early intervention. When Participant Male A was too dependent on his mother, it was difficult to judge whether his symptoms and comorbidities or lack of motivation to learn caused his physical and emotional weaknesses and cognitive abilities. Thus, researchers should consider the impacts of family relationships on developmental trajectories and individual differences in predicting treatment outcomes for children with ASD.

CONCLUSION

As autism is a spectrum disorder, no one treatment program can treat all the autistic symptoms. Not every individual with autism can benefit from the same treatment programme as others. Apart from the individual differences and development trajectories, family relationships also play a vital role in ensuring success an early intervention for children with ASD. Although there is limited

literature on music and movement intervention, this intervention had the potential to help children with ASD improve their sensorimotor and socio-emotional development. Music and movement therapy provides children with ASD the opportunity to learn synchronising and coordinating their body movement with the rhythmic stimuli embedded within music. This kind of motor synchronisation is the foundation in helping children with ASD to develop their social abilities. However, a lack of literature on examining the therapeutic effects of music and movement has undermined parents' decisions on choosing music and movement intervention as a complementary treatment for sensorimotor and socio-emotional dysfunctions in their children with ASD. Researchers can conduct more studies on the therapeutic effects of music and movement intervention, primarily based on the concepts of rhythmic, social, and musical entrainments.

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