Exploring Young Children's Communication Development through the Soundbeam Trigger Modes in the 'Holistic Music Educational Approach for Young Children' Programme

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Abstract

The Holistic Music Educational Approach for Young Children (HMEAYC) is a professional method that aims to provide a music curriculum for children in both mainstream and special education settings. The purpose of this research was to examine the effectiveness of the HMEAYC in communication development through the use of the Soundbeam trigger modes in young children from the mainstream and with special needs. The participants were divided into two groups, and they were aged between 41 and 55 months. All the children received the same number of hours of music instruction per week incorporating the 'Soundbeam technology' adapted from the HMEAYC method. The duration was 32 weeks with a 40-minute instructional session once a week. The results and findings showed that both of the groups increased their participation in the musical activities and improved their communication ability by the end of the study. The findings suggest the HMEAYC curriculum framework is beneficial for making connections between music activities and comprehension processes in communication. The results showed that in the autism spectrum disorder children and young children, the manipulation behaviours are both related to single operation through the Soundbeam trigger modes in the HMEAYC.

Keywords: holistic music educational approach, young children, communication development, Soundbeam, trigger modes

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Introduction

'Holistic development' is an educational goal that seeks to address a child's spiritual, physical, relational, intellectual, and linguistic abilities to simultaneously set them on a positive learning path in early childhood. There is evidence that musical activities assist with early language development and emotional well-being and that the benefits of music can contribute to the development of children (Moore, 2013; Murray, 2005; Schon, Boyer, Moreno, Besson, Peretz, & Kolinsky, 2008). Therefore, musical activities should create communication opportunities to engage with young children. In this aspect, singing, rhymes, musical games, and playing instruments are efficient ways to communicate with young children. Music can be utilised to cue the rate (e.g., faster or slower), manner (e.g., even or syncopated patterns for walking vs. skipping) or direction (e.g., moving to one location) of physical movement to enhance children's motor development (Gfeller & Darrow, 2008). Music participation has a positive effect on the personal and social development of young children (Hallam, 2010). Effective musical communication requires the conveyance of the intended message in a manner perceptible to the receiver (Whipple, Gfeller, Driscoll, Oleson, & McGregor, 2015).

The Holistic Music Educational Approach for Young Children (HMEAYC) is an activity designed for young children and children with special needs that integrates music education and music therapy. The lessons of therapy are designed according to the development of the children's physical and mental needs. Music, as a medium for children to learn, is used as an 'education principle' and is expected to achieve the purpose of integrating 'education and treatment'. Teaching teams design a variety of music activities to enhance the effectiveness of special learning in young children by implementing courses in music (Lee, 2016). The HMEAYC is a model that has combined theory, hands-on practice and experience for more than 20 years. It is an innovative music educational model that fuses contemporary science and technology, multi-sensory equipment and traditional instruments with creative music (Lee, 2008, 2012). The HMEAYC uses music as a medium to enhance the interconnectedness of the mind, body and spirit from a young age. HMEAYC educators may plan or assess ability development with a focus on a particular outcome or component of learning because they see children's education as interconnected.

Soundbeam technology uses a motion sensor to enable patients with special needs to express sounds or music through their limbs, helping to improve both their gestural control and full body motions (Swingler, 1994, 1998; Swingler & Brockhouse, 2009; Jacoby, 2013). Foreign countries have been developing this technology for more than 20 years. In 2007, Taiwan imported the first set of instruments from the United Kingdom. Although it has been in usage for nearly 10 years, it is still a novel technology that has been designed primarily for use within special needs education and/or therapeutic settings. Relevant empirical studies have found that Soundbeam usage for the rehabilitative therapy of children with disabilities has a highly significant result for disabled children (Ellis & Leeuwen, 2000; Ellis, 2004). Practical research in Taiwan has found that the integration of designed activities into scientific instruments can enhance the learning motivation of both mainstream and special needs children (Lee, 2011b; Lee & Lin, 2013).

The primary purpose of this study is to examine the effectiveness of HMEAYC, a framework that uses music activities to facilitate communication. As such, the specific research questions asked are as follows: 1) Can the HMEAYC improve comprehension in the communication skill development of mainstream children? 2) Can researchers learn more about the communication needs of young children through the trigger mode of the Soundbeam in the HMEAYC? This study will provide recommendations based on its findings.

Literature Review

HMEAYC is attuned to each child's individual personal programme and assesses learning by synergising and integrating opportunities for learning. Liza Lee at Chaoyang University of Technology, Taiwan, who has been implementing and promoting the HMEAYC for 16 years, has found it to be an effective educational programme for young children (Lee, 2011a, 2015; Lee & Lin, 2013; You & Lee, 2016). In 2016, Lee shares HMEAYC results in the conference paper entitled 'An Empirical Study of Holistic Music Educational Approach for Young Children on Communication Development'. HMEAYC is an activity designed for young children and children with special needs via an integrated curriculum that translates theories into hands-on practices, integrating music education and therapy into one (Lee, 2016). Research has found that children's language and body movements increased (Lee, 2016; Lee & Lin, 2015), and found that children with special needs had improved language, attention and body movements when an HMEAYC curriculum framework was used to enhance the development of these abilities (Lee, 2015; Lee & Ho, 2017; Lee & Li, 2016; Lee & Lin, 2013; Lee & McCord, 2012).

The HMEAYC involves the principle of repetition in the curriculum design and is expected to achieve its objectives through various arrangements and tempo changes to the same songs and rhymes. It enhances children's abilities through the principle of repetitive learning. There is no fixed formula for the children's music education curriculum, but adjustments are possible because all teaching activities are beneficial to children's holistic development. The curriculum includes a hello song, an attendance song, musical games, musical storytelling, musical movement, relaxation time and a goodbye song (Lee, 2016). The following illustrates the curriculum design. Each activity has specific purposes: the hello and goodbye songs are designed to improve children's sense of order (beginning and end of the curriculum) and provide a preview and review of the teaching objectives; the attendance song improves self-awareness and social interactions with the instructor and peers; relaxation time helps children attain calmness before the class ends. These all occur at fixed times during the class. Other teaching activities, such as musical games, musical storytelling and musical movement, may be expanded or reduced (Lee, 2012, 2015, 2016). The HMEAYC enhances the learning experience on four dimensions:

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1) Children: Since the HMEAYC can be applied to all children, including those with special needs, it is a conventional and inclusive education curriculum;

2) Field: the HMEAYC incorporates interactive activities from all fields of study since it is a multi-dimensional, multi-layered method of special music education;

3) Faculty*:* teachers from various fields of study who acknowledge the intrinsic and inborn nature of music are brought together to achieve a better result of music education. Furthermore, parents are also thought of as inherent music teachers for their children;

4) Methodology: the fully assimilated and the wholly integrated conventional education models provide the means to incorporate modern technology and improve education. By using diversified teaching methods, this technique can inspire children's explorative motivations, thereby taking advantage of their talents and aptitudes.

Effects on young children's communication development

In a heterogeneous classroom setting, different learners may differ in their judgement of the HMEAYC's musical activities. These activities can foster open discussion, encouragement, tolerance, open-mindedness, and diversity. Outcomes vary depending on students' needs as those with different types of communication disorders may be decode music differently (Whipple et al., 2015). Findings have shown that those with music familiarity exhibit musical expertise and phonological awareness. This also illustrates that music has an influence on language abilities, particularly music resources, tone hierarchy cognition, and perception (Besson, Schon, Moreno, Santos, & Magne, 2007; Tillmann, 2014). Therefore, the processing functions of music and language have a close relationship (Bhatara, Yeung, & Nazzi, 2015). Music and speech have many aspects in common since linguistic and musical syntactic integration rely on musical harmonic processing to activate anterior language areas (Patel, 2003; Perrachione, Fedorenko, Vinke, Gibson, & Dilley, 2013). Music has a myriad of functions, such as helping children with special needs gain the ability to communicate (Hargreaves, MacDonald, & Miell, 2005; Lee, 2012; Lee & Lin, 2013), strengthen their attention span or trigger a physical response (Luo, Guo, Lai, Liao, Liu, Kendrick, Yao & Li., 2012).

Some studies have suggested that communication and movement may be conveyed to children with Autism Spectrum Disorder (ASD) through musical interactions (Adamek & Darrow, 2005; Adamek, Thaut, & Funnan, 2008; Lee & McCord, 2012; O'Riordan & Passetti, 2006; Whipple et al., 2015). Thus, music may be an effective therapeutic tool for exploring the expression of communication-related interventions (Dieringer, Porretta, & Gumm, 2013; Hooper, Wigram, Carson, & Lindsay, 2008a, 2008b). Therefore, it may be surmised that communication will benefit from motion in accordance with sound, as when Soundbeam, multi-sensory instruments and equipment are applied and used in the curriculum (Lee, 2011b, 2012; Lee & Lin, 2013, 2015). Soundbeam technology provides a powerful physical and psychological stimulus. Stimulating the individual involved in sound therapy has proven to be highly effective across a range of disabilities, including those with special needs, such as children with ASD (Ellis & Leeuwen, 2000).

In summary, the HMEAYC uses music activities and Soundbeam technology to incorporate both play and learning in the education of young children. For most of those with disabilities, being able to improve their learning effectiveness through music is positive (Lee, 2008, 2016). All teaching methods lead to multiple developments. Music teaching, like any form of educational activity, is not merely a means, but also a medium. The Music can be seen as a representation of sound and is displayed as an image to evoke emotions in the children (Hallam, 2010; Moore, 2013). In previous studies and instructions, this research team has seen the positive effects from the challenging experiments on children's development. Through interactions with musical instruments and performances, preschool children with developmental delays can improve their comprehension effectiveness, physical movements, and social skills. Previous HMEAYC and Soundbeam research have found that these methods and technologies can help children with special needs improve their motor skills or attention ability (Lee, 2015). The study also found that HMEAYC has positive effects on language and communication (Lee, 2008; Lee & Lin, 2015; Lee & Ho, 2017). HMEAYC practices are proven to improve communication development for children aged six or younger and children with special needs. The primary purpose of this study is to examine its effectiveness. We hypothesise that the HMEAYC improves comprehension in the communication of young children and children with special needs and we hope to find out more about the communication needs of young children through the Soundbeam technology.

Methodology

Participants

Parents and/or guardians provided written informed consent for the 23 children who participated in this study before their enrolment. The research sample was composed of children from a city child development centre and a private preschool located in the metropolitan Taichung area in Taiwan. This child development centre has provided a non-profit 'Early Intervention Service' for children with disabilities, and a paediatrician and other medical professionals formally conducted the children's diagnosis with the disorder. Based on previous research, the results showed the language effectiveness of using music activities for children ages 36–60 months (Lee, 2007, 2008; Lee & Ho, 2017; Lee & Lin, 2013). We hypothesised that HMEAYC's promotes language effectiveness would be most substantial at ages 36–60 months. The participants were selected by purposive sampling to participate in the study and sorted into two groups of children aged 41–55 months. The data regarding the age of the participants refer to the research phase.

Group 1 included seven children, two girls and five boys. These seven children all had ASD (Asperger's syndrome, N=5, or high-functioning autism, N=2), and they had enrolled in an early intervention centre (M = 48.14 months; SD = 1.98).

Group 2 included 16 children and consisted of seven girls and nine boys enrolled in a private preschool (M = 46.81 months; SD = 3.68).

Table 1

Demographic information (N=23)

	Number	Gender [1]	Diagnosis[2]	Sample source[3]
Group 1	1	g	H	
	2	b	A	
	3	b	A	
	4	b	A	CDC
	5	b	A	
	6	b	A	
	7	g	H	
Group 2	1–9	b	N	PP
	10–16	g		

[1]b=boy, g=girl; [2]High-functioning autism=H, Asperger's syndrome=A, No symptoms=N; [3]child development centre=CDC, private preschool=PP

Materials and instruments

1) Communication development: To understand the participants' communication development capabilities, this study employed Harrison and Oakland's The Adaptive Behaviour Assessment System-Second Edition (ABAS, 2–5 years old). This study used the Chinese version of the scale translated by Lu and Chen (2009) to provide a complete assessment of the adaptive skills of Taiwanese children's development. The key areas measured included functional academics, self-care and community self-direction to provide a comprehensive assessment of the adaptive behaviour and skills of individuals from 24 to 71 months. The questionnaires showed an internal consistency of .88–.91, indicating that the scale has a very good reliability. This is the main source of quantitative information. Studies have employed this scale to measure the communication ability of participants. Data for statistical analysis was collected twice: during the pre-test in the baseline stage and during the post-test upon the teaching activity's termination.

2) Trigger mode-beams: To further understand the participants' comprehension processes during communication and music activities, this study employed the trigger mode of Soundbeam5 (Figure 1, a photo for The Soundbeam device). We used the Chinese version of the guidebook translated by Lee (2011a). The trigger modes are classified as 'single', 'multi', 'sustained-single', 'sustained-multi','cyclic-single', and 'cyclic-sustained'. This is a controller that uses ultrasonic beams and switches to turn movement into sound. The other single-clipped and multi-clipped options were not included, nor were those that require the usage of a screen button, such as →, + or -. The researchers sampled records of qualitative observation and coding, and then conducted an analysis of the participants' videotaped process based on the coding scheme. Additionally, the assessment of inter-rater reliability to demonstrate consistency among observational ratings was provided by multiple coders. The kappa value of the inter-rater reliability was calculated to ensure the reliability of this coding scheme, and the six coding categories are as shown in Table 2. Analysis revealed the reliability of the Kappa coefficient to be 0.86.

Figure 1. Soundbeam device.

Procedure

The goal of the study was to assess participants' communication using the HMEAYC. Before the study entry, the participants' parents had already provided written informed consent for the research. Each child was individually tested on a variety of communication tasks, including a receptive vocabulary task. Prior to the formal teaching, two observations were taken to determine the participants' communication abilities. Repeated communication between the participants was permitted during this process. For Group 1, the participants' communication development focused on the understanding and expression of the Chinese spoken language. For Group 2, since their native language was Chinese, it was difficult to show an objective result caused by teaching the music in Chinese. As such, the research design for Group 2 integrated a foreign language, English, into the music teaching research. Both groups received the same curriculum framework as Chase's (2004) research, and we found that most of the existing literature assessed the data

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collection through behavioural observation (Tam, Scwellnus, Eaton, Hamdani, Lamont, & Chau, 2007). The study was approximately a 40-minute session once per week and focused on the Holistic Music Educational Approach (HMEAYC). The total 32-week HMEAYC intervention was recorded in a multi-sensory classroom. The entire operational process of each participant during the Trigger Modes was video-recorded for subsequent analysis. At 32-weeks, each child was individually tested again on a variety of communication tasks.

Data analysis

The study required music therapist qualifications for teaching activity implementation depending on the enactment of the situation design and the administration of activities that were beneficial to the children's development. The teaching collaborator assisted in the process of the teaching activities, and the skilled observers coded a large amount of video data. Four observer coders with early childhood education or special education related departments were recruited and subjected to half a year of professional training. The observer's video analysis did not enter the research field. When assessing the participants' initial behaviour prior to the formal teaching, observations were taken to obtain the participants' condition. The observations concluded when the observers were in agreement about the specific nature of the participant's behavioural challenges. The data revealed the assessment standard of communication, and a low score indicated that the participants had no understanding of a spoken language. The null hypothesis was that the HMEAYC did not improve the comprehension processes in the communication development of mainstream children and did not improve their ability to follow instructions by spoken language and/or their physical reactions. On the contrary, a high score showed that the participants had a full understanding of a spoken language. The study's hypothesis was that the HMEAYC improved the comprehension processes in the communication development of mainstream children, including their ability to follow instructions and respond via spoken language as well as their physical reactions. Further research should investigate the comprehension processes of communication and music activities. We conducted a lag-sequential analysis of the participants' Trigger Mode coded frequencies using the six behaviour codes (i.e., S, M, E, I, C and Y). To ascertain the sequential behaviour pattern, an analysis of the participants in different groups was conducted. All behaviour codes frequency data was followed by the analyses on the transfer matrix of behavioural frequency, conditional probability matrix, and expected value matrix. Finally, the adjusted residuals table (z-score table) could be inferred (Bakeman & Gottman, 1997; Hou, 2010, 2015).

Results and Discussion

In this study, learning effectiveness was observed to be related to a focus on communication progress. For this study, the qualitative and the quantitative data had equal weight, and results collection was completed using an integrated qualitative and quantitative method. A quantitative data assessment scale was used for the observers, while the qualitative data was from a videotape written by the observers. The data was collected and analysed using the SPSS statistical software. The qualitative information from the participants' videotapes was coded (G1=Group 1, G2=Group 2; b=boy, g=girl; the number represents the serial number).

The Changes of Group 1's Communication Skills

Table 2 shows ANOVA results regarding HMEAYC and Soundbeam technology's effect on ASD children's communication comprehension processes. Table 2 gives the results for Group 1's communication skills factors. Group 1 included seven children, two girls and five boys, and their effectiveness factors yielded significant differences in their communication skills (F=4.66, $p < .001$). According to the post hoc tests result, Group 1's communication skills showed a higher effectiveness on G1g1 than G1b2.

Table 2

Group 1's Communication Skills ANOVA

	Sum of Squares	df	Mean Square	F	Sig.	post hoc tests
Between Groups	2850.14	6	475.02	4.66	.001***	G1g1>G1b2
Within Groups	3565.00	35	101.86			
Total	6415.14	41				

****p* < .001.

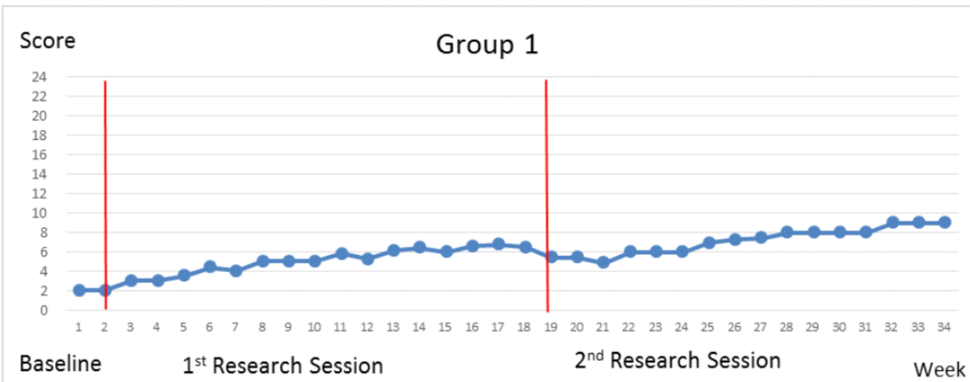

Figure 2. The process of Group 1's changes of communication skills.

The baseline

Group 1 included two girls and five boys with ASD diagnoses. Prior to the formal teaching, two observation reports detailed that Group 1 indicated no understanding in the classroom most of the time. Figure 2 shows Group 1's communication skills at the baseline, after the first research session, and after the second research session.

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Even though the curves are up and down, they indicate the level of progress for the participants' communication development. Figure 2 shows Group 1's communication skills from the lowest score of two at week one to the highest score of nine at the end. They had difficulty following instructions with physical responses and had no spoken language in the classroom.

The First Research Session

Figure 2 shows that the participants of Group 1 had no competence with communication skills, including understanding and expressive language, for three weeks. According to the observation forms and the teacher's reports, Participants G1g1 and G1b3 showed resistant behaviour during the first session. From weeks six to nine, most of the participants became familiar with the activities, so this score increased gradually. The speech therapist's reports indicate that during the speech therapy session, most participants would respond to their names when they sang the attendance song that was used in the music session. At week 10, Participant G1b4's negative behaviours caused a distraction for the other children, so the score went down a little. From week 11 to the end of the first session, all of the participants showed stable progress. Based on the interviews with the classroom teachers and therapists, the participants responded to the instructions better when singing familiar songs.

The Second Research Session

The second research session began in week 17. There were two weekly review sessions to help the participants become used to the learning process. Compared with the first session, Figure 2 shows that the participants maintained a stable learning performance. When they began the new thematic topic at week 19, the participants had to accommodate themselves to the change in situation, so the score went down. This lasted for four weeks. At week 23, all of the participants had physical responses, and a few were able to copy a single word. By the end of the session, even though the curve moved up and down, eventually, the participants made a positive level of progress in their communication skills. Participants G1g1 and G1b3's negative behaviours were reduced at this stage, especially during the musical storytelling time, to which all of the children attended the most. They were able to concentrate on the story's contents and copy partial fragments of the songs. Participants G1g1, G1g2, G1b3, G1b4, G1b5, and G1b6 would sing the songs that were used in a music session. Though Participant G1b7 did not respond to the physical therapy's spoken language, he would respond to the singing voice by shaking his hands. In the final interview with the caregivers, Participant G1g1's grandmother showed her appreciation to the research team. She said that Participant G1g1 had started making sounds, copying words, and singing songs at home. The classroom teachers indicated their interest to in incorporating the music elements into their daily lessons as well after observing the HMEAYC's instructions.

The Changes in Group 2's Communication Skills

Table 3 shows the ANOVA results for HMEAYC and Soundbeam technology's effect on young children's comprehension processes in communication. Table 3 gives the analyses of Group 2's Communication Skills factors. Group 2 included 16 children, and the effectiveness factors yielded significant differences in their communication skills (F=1.84, p < .05). In the post hoc test comparison, it was found that Group 2's communication skills showed a higher effectiveness for G2b9 than G1b2.

Table 3

Group 2's Communication Skills ANOVA

	Sum of Squares	df	Mean Square	F	Sig.	post hoc tests
Between Groups	1934.50	15	128.97	1.84	.042*	G2b9>G1b2
Within Groups	5598.00	80	69.98			
Total	7532.50	95				

$^{*}p < .05$

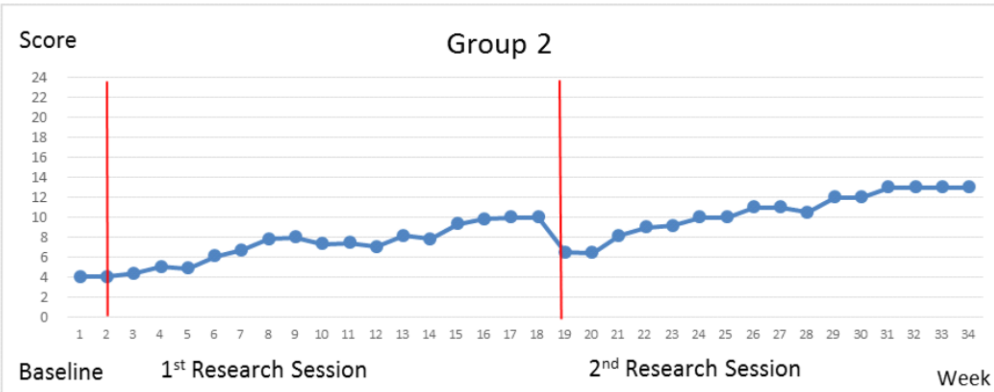

Figure 3. Group 2's changes in communication skills

The baseline

The participants of Group 2 included seven girls and nine boys enrolled in a private preschool. To receive an objective result, Group 2's main language of teaching was English. From two observations made during school hours, Group 2 showed no understanding of English. The classroom teachers said that no participants in Group 2 had school experience in either foreign language or music learning. Group 2's communication skills were recorded at baseline, after the first research session, and after the second research session. Figure 3 shows Group 2's communication skills from the lowest score of four at week one to the highest score of 13 at the end. They had difficulty of following instructions, as shown by their responses.

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The First Research Session

Initially, no participants in Group 2 responded to the instructor during the session. This might have been due to the accommodation period of the school experience as well as the foreign language. Participant G2b1 showed his negative emotions and resistant behaviour for five weeks while the other children were still discovering their brand new learning environment. From weeks four to nine, Group 2 was able to follow the directions for physical responses, such as: 'Girls, stand up,' 'Have a seat,' 'Make a big circle' and 'Clap your hands'. At week 10 and week 12, Participant G2b1 started showing his negative emotions by crying and asking to be held, and this disturbed some of the children. From week 13 to week 16, all of the participants' attention was able to be captured by the music activities. Specifically, the musical storytelling time held the children's attention the most. This stability lasted until the end of the first session.

The Second Research Session

The second research session started in week 17. Due to the new thematic topic, the participants did not respond to the instructor except for during the 'Hello Song'. Two weeks later, during the week 19th session, all participants were used to the learning environment and the teaching style, especially during storytelling time, and they were able to concentrate on the different methods. They responded to the instructor more often both physically and orally. Even Participant G2b1, who took the longest time to become used to the class, was able to copy, follow, and respond to the instructor and teaching collaborator at this stage.

Sequential Patterns of Trigger Modes

The study further conducted the lag-sequential analysis on the six behaviour codes (S, M, E, I, C and Y). A z-score greater than 1.96 indicates significance statistically since it indicates continuity in the behavioural sequence of a certain specific initial behaviour. This was followed by a certain specific subsequent behaviour during the process (Bakeman & Gottman, 1997). According to Table 4, the Trigger Mode patterns of the participants can be derived, as shown in Figures 4–5. The Trigger Mode is signified with a square. Values needed to be greater than +1.96 for the sequence to be significant and for the behavioural transition pattern to be further deduced. Moreover, the arrows indicate the direction of the sequence, and the line segment thickness indicates its significant extent (Hou, 2010, 2015).

Table 4

The adjusted residual Table for Participants' Trigger Mode

	S	M	C	Y	I	E
Group1						
S	1.97*	-1.25	-1.23	1.05	-0.92	-0.41
M	-1.04	0.94	-0.35	-0.81	0.75	-0.17
C	-1.55	-0.35	5.55***	-0.61	-0.44	0.58
Y	-0.34	1.20	-0.61	-0.21	-0.57	-0.26
I	0.30	-1.01	1.37	-0.57	0.41	0.73
E	-1.54	-0.17	-0.75	-0.26	6.45***	2.82**
Group2						
S	-28.41	-0.34	-0.97	-1.64	0.1	-1.5
M	5.74***	-8.27	-5.03	-3.46	-2.95	-0.78
C	3.62**	-2.7	-7.12	-2.02	-4.64	-1.5
Y	3.57**	-4.53	-2.97	-5.05	-2.95	0.73
I	4.37***	-2.86	-2.96	-2.14	-3.68	-0.71
E	1.34	-1.45	-0.75	-0.31	0.11	-0.53

$^*p < .05$、$^{**}p < .01$、$^{***}p < .001$

In this study, we describe the respective significant behavioural sequences and discuss their features as well as each group's behavioural patterns. This analysis considers both the participant's behavioural frequencies and their sequential patterns, thus attaining a deeper understanding of their learning processes. The results in Table 4 and Figures 4–5 show that Group 1's behavioural patterns had different frequencies of average learning behaviour for each of the three main types—analysing, exploring and manipulating (S->S, z =1.97; C->C, z =5.55; E->E, Z=2.82). In terms of the sequential patterns, the participants from Group 1 only showed the sequential behaviour pattern of analysing to repeated manipulations on the Sustained-Multi transfer to Sustained-Singles (E->I, z = 6.45). Group 2 better performed a certain degree of the manipulation cycle behaviours related to the Single operation. Unlike Group 1, the participants were shown the sequential behavioural pattern to analyse 'ending after Single' (C->S, z =3.62; I->S, z =4.37; Y->S, z =3.57; M->S, z =5.74).

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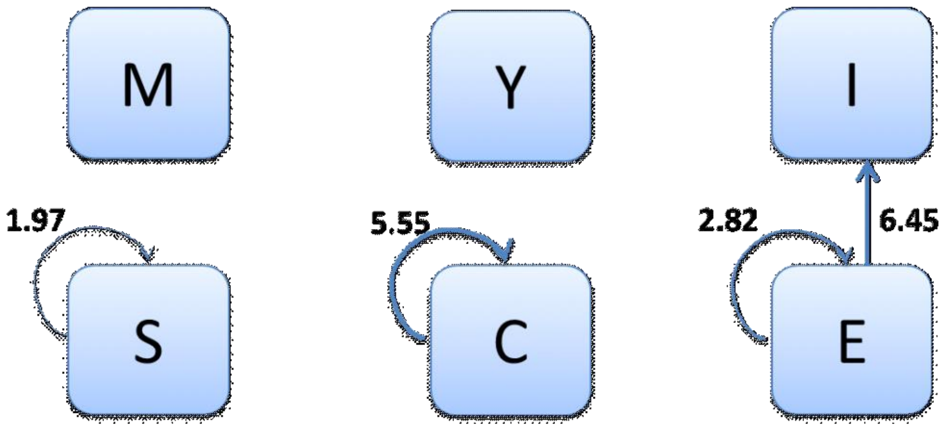

Figure 4. The Trigger Mode transition diagram of Group 1.

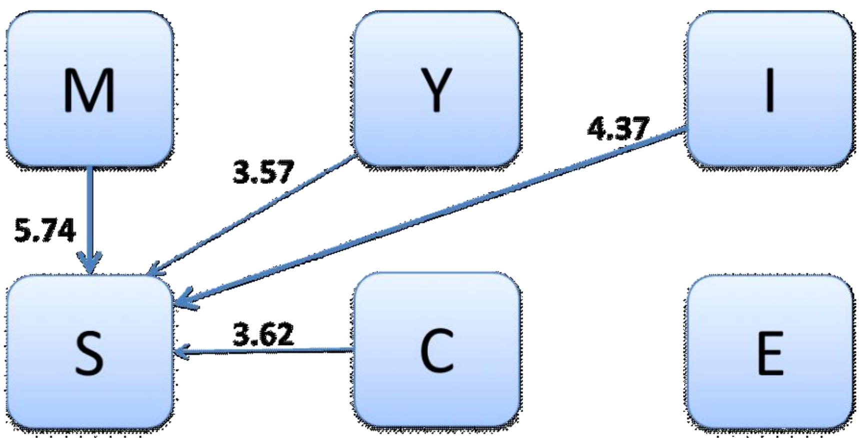

Figure 5. The Trigger Mode transition diagram of Group 2.

Conclusion

Our conclusion is that certain studies related to the issue of the discovery of the HMEAYC and Soundbeam technology as a whole are opening up new perspectives on the learning process of communication development. This could aid in the understanding of the similarity between the communication development of children in both the mainstream and special education settings, as during the research procedure, where children learned communication ability and to express themselves through the music of sounds.

A total of 32 weeks of HMEAYC class sessions were conducted in this two-phase study. The results showed that the two groups of very young participants achieved positive communication development changes after partaking in musical activities using the Holistic Music Educational Approach. Studies have suggested the potential advantages of music as a therapeutic tool for goals related to either communication or movement (Patel, 2003; Hargreaves et al., 2005; Perrachione et al., 2013). This not only showed the positive effects of engagement with music on the communication process, but also showed that music can be a viable treatment medium to assist in developmental delay (Dieringer, Porretta, & Gumm, 2013; Hooper, Wigram, Carson, & Lindsay, 2008a, 2008b; Matson, Bamburg, & Smalls, 2004).

According to the observed data, both groups exhibited extraordinary changes. During the course of the experiment, Group 1's participant communication development increased. Therefore, the HMEAYC is a viable method for most young children with disabilities to improve their language skills (Lee, 2008). Evidently, participating in music helps advance the communication skills of those with ASD (Adamek & Darrow, 2005, 2008; Lee & McCord, 2012; O'Riordan & Passetti, 2006; Whipple et al., 2015). The result of combining music with Soundbeam to produce better learning results is the same as the method Swingler and Brockhouse (2009) used in children with autism, and Ellis & Leeuwen (2000) found similar outcomes. The results of this study confirm the learning effect of multiple sensory stimulations using music with technology instruments in Taiwan (Lee, 2011b, 2015; Lee & Lin, 2013). The results showed that the participants' communication skills in the Trigger Mode were distinctively different.

The findings of the HMEAYC curriculum framework were beneficial for making the connections between the music activities and the comprehension processes in communication. The behaviours are both related to the 'Single' operation through the Soundbeam trigger modes in the HMEAYC. In terms of the sequential patterns, the ASD children from Group 1 tended towards the simple operations such as Single, Cyclic-Single, and Sustained-Single, or the repeated manipulations of the Sustained-Single transfer to Sustained-Multi. These repeated manipulation behaviours are both related to the Single operation. This action appears to repeat the playing of a single tone. During the course of the experiment, Group 2 participants also displayed improvements in their positive communication skills. The HMEAYC of the preschool children was correlated with their communication development outcomes. The preschool children from Group 2 performed better when shown the sequential behavioural pattern to the ‘ending after Single’. This seems to be an action for denoting the end of the music. The results regarding music participation’s effect on learning outcomes are the same as those found in Besson et al. (2007) and Bhatara et al. (2015). In Group 2, the design integrated the English foreign language into the research music teaching. During the analysis phase, they tended to emphasise a Single ending, which may have facilitated their complete experience of the music and their procedural learning process.

Specifically, the HMEAYC plays a key part in developing early speech skills and improving the results of learning a foreign language for special needs children. This sets the foundation for the HMEAYC being an effective way to elevate and develop their communication capabilities. Based on these results, the HMEAYC was proven to provide a fun way to develop communication opportunities for young children. Although there are many expected benefits of this study, there are some limitations with the HMEAYC. One of them is that the results cannot be generalised due to the small sample size. There is a need to expand the numbers and areas of the participants, and since this approach cannot be mass-produced at present and is not available online, the promotion of the HMEAYC guide is limited. The training of more teachers and parents in the importance of helping their children become much more involved with this approach would meaningfully expand the effectiveness of the education aspect of HMEAYC and would support its development. Further study of how the HMEAYC can be related to general issues in communication for both children in the mainstream and individuals with severe disabilities and ASD is recommended. It is also necessary to determine the long-term effects of the HMEAYC approach on children’s development in communication and other skills. It would be helpful to study the HMEAYC approach with a larger variety of children across many age ranges to determine if there are any long-term benefits to using this approach.

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