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OptiMusic for Children with Special Needs

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Abstract

OptiMusic training uses a unique audio-visual system to utilize a combination of lights and sound to train children with special needs to explore and interact with the environment. The training encourages children to create music and sound effects by sweeping a bat across the light beams. It is an enjoyable way for children with behavior challenges and learning difficulties to engage with their surroundings. It can be used to teach concepts, cause and effect, communication, social skills, teamwork, fine-gross motor skills (particularly hand-eye coordination), musical timing and rhythm, audio-visual memory, and aural sequencing. It is very flexible and can be tailored to the needs and different levels of children with special needs. OptiMusic training for children with special needs uses a variety of music, sounds and images to create a powerful, multi-sensory and learning environment for these children.

In this article, we would like to share our experiences and learnings gained throughout the development of the OptiMusic programme for children with special needs. There is an introduction to the system; structure and curriculum; and creative ideas and activities in the programme.

Keywords : OptiMusic, OptiMusic programme, Children with Special Needs

Introduction

In this article, we would like to share our experiences and learnings gained throughout the development of the OptiMusic programme for children with special needs. OptiMusic is a unique audio-visual system that is played by interacting with coloured light beams. The OptiMusic system has:

(a) Interactive colored light beams with a sensor. Each beam produces a narrow beam of light that is used as an input device. When a light beam's path is disrupted by a reflective item, the sensor detects the reflection and a switch is activated. This switch sends a signal to the OptiMusic software program, which then sends a signal to the stereo speaker to play a certain sound.
(b) OMPC-AV software for triggering images and videos.
(c) USB Control System which includes Multi-Media PC, software and hardware including a microphone.
(d) Button Box with buttons to control all aspects of the OptiMusic system.
(e) Reflective items include OptiBats, OptiPads and OptiMits.
(f) User Manual to provide information on how to operate the OptiMusic system.
(g) User Guide that gives instructions on its use and application including comprehensive session ideas and structure. It also highlights the potential skills that can be developed for individuals with special needs.

The colored light beams shine down on the floor acting as visual reference points for the user. Reflective items are used to create signals by

reflecting or breaking the light from the beams. The signals will then produce music and sounds from the OptiMusic system. The beams can be played in two modes, the normal mode and inverse mode. Normal mode uses hand held reflectors such as OptiBats or OptiMits to trigger the beams. The beam will play when the reflector is placed under the beam and will stop triggering when the reflective surface is removed. Inverse mode uses floor/ surface reflectors so the beams can be triggered by hands and/or body movements. The beam will play when the reflective surface is blocked and will stop triggering when the beam can sense the reflective surface again. The OptiMusic system is easy to use. Once the installation of equipment and software is complete, the user will only need to turn on the power switch and the system will be ready for use in 60 seconds. The system needs only a basic setup of computer, mouse, keyboard and User Button Box. The user can easily navigate through and edit the programs using the mouse and keyboard. The User Button Box is used to control the volume and selecting pre-programmed settings. The system allows the user to easily edit the existing settings or add their own sounds and music, as well as record voices using the microphone provided. The user can customize and create different settings to meet the needs of the participants and provide training for relaxation, stimulation, education and creativity. The OptiMusic system can also be used as a musical instrument, a powerful communication tool, and an invaluable teaching aid. It allows a combination of musical activities, images, interactive games and sound.

OptiMusic, with its unique audio-visual system that combines lights and sound, can be utilized to train children with special needs to explore and interact with their environment. The system encourages children to create music and sound effects by sweeping the reflective items across the light beams. The lights and sounds are attractive and can capture children's attention. It is an enjoyable way for children with behavior challenges and learning difficulties to learn about their surroundings. Children with special needs have impairments in receptive and expressive language, and often lack self-confidence and self-esteem when they perform in public or in front of an audience. OptiMusic training allows them to take control of the music, develop positive self-esteem, and improve communication and interaction with their friends. OptiMusic can be used to teach concepts, cause and effect, communication, social skills, teamwork, fine-gross motor skills (particularly hand-eye coordination), musical timing and rhythm, audio-visual memory, and aural sequencing. Body movements, singing or improvised singing can help children to develop indirect communication. Moreover, listening to a variety of musical instruments and different vocal sounds can improve the auditory skill of children with autism (Adamek & Darrow, 2005). Extra activities can be integrated into several areas of learning, including music, arithmetic, story-telling, simple games and dancing, when using OptiMusic. The system has a variety of musical instruments, nursery rhymes, festive songs, and sounds from home, nature etc. Ideas on running the sessions depend on the creativity and experience of the facilitator.

The effects of Audio-Visual Aids on Children with Special Needs

As OptiMusic uses light beams and sounds, it is considered an audio-visual aid for children with needs. Though no scientific research was conducted on the effect of OptiMusic, the effects and usefulness of other audio-visual aids on children with special needs were explored. William, Massaro, Peel, Bosseler & Suddendorf (2004) in their research explored visual-auditory integration during speech imitation with autistic children, by using a computer-animated program combined with a 'virtual' talking head ("Baldi")

which delivered speech stimuli in the auditory and visual training. A virtual talking head ("Baldi") is one of the technologies used to teach language skills. Its visible speech movements are carefully based on recognized patterns of facial and tongue movements known to be associated with different forms of pronunciation. "Baldi" has proven to be a useful tool for teaching both deaf and autistic children to speech-read and develop their language skills (Bosseler & Massaro, 2003; Massaro, Bosseler & Light, 2003). The results show that a combination of visual and auditory input provided the children with a clearer picture of how speech is formed and thus improved the children's ability to utilize visual information in their verbal processing. Olmstead (2005) examined the effects of auditory and visual stimulation (AVS) on four specific cognitive abilities in children diagnosed with learning disabilities, who demonstrated low and below average scores on the Wechsler Intelligence Scale for Children (WISC-III) Symbol Search, Coding, Arithmetic, and Digit Span (SCAD) profile. The AVS device called the Pro Tutor is a small, plastic, battery-operated device consisting of headphones and white full-spectrum eyeglasses. A compact disc (CD) and cassette player with a selection of Walt Disney story soundtracks was added to the device. The AVS sessions were administered two times weekly for six weeks to assist in better outcomes. The results confirmed that AVS produces significant changes in cognitive abilities as measured by the WISC-III SCAD profile in participants with learning disabilities. Three studies were conducted by Magnan & Ecalle (2006) using a developed audio-visual training program (Magnan, Ecalle, Veuillet & Collet, 2004) to investigate the usefulness of intensively training children with reading disabilities using daily exercises based on voicing contrasts. The newly developed audio-visual program is an innovative instructional system that provides exercises for children with reading problems, which are designed to stimulate skills identified as important for successful reading acquisition. These results suggested overall, that the intervention improved the pre-reading skills of the experimental group. The children made progress in word recognition and enjoyed working with the program. A study by Kast, Meyer, Voegeli, Gross & Jaencke (2007) was done to show the effect of visual-auditory multimedia training for children with developmental dyslexia. Participants underwent three months of intensive visual-auditory multimedia training. Participants needed to match the letters or syllables to the correct colors, shapes and sounds to make the correct word. Results showed that the participants improved in their writing skills and were able to transfer the learning to words that were not used in the training. A study by See (2013) showed that audio-visual cognitive aid is effective in understanding the thought pattern of children with autism and is a means of modifying their thinking and behavior. The audio-visual cognitive aid helped children to maintain attention, understand and connect with their environment. Their speech ability, hand-eye coordination, and memory improved while inappropriate behaviors decreased.

Audio-visual aids and computer-assisted language instruction (CALI) are associated with the improvement of language skills such as receptive skills, productive skills and language components (Gilakjani, 2012). These aids were found to be useful, not only for normal students, but also for students with special needs (Kirk, Prusick, French, Gotch, Eisenberg & Young, 2012). A study by Al-Yaari (2013) attempted to test the main and interaction effects of using audio-visual aids and computer-assisted language instruction (CALI) in the performance of speaking skill among students with special needs. Results supported the idea that using audio-visual aids and CALI are important in teaching language skills in general and speaking skill in particular.

Uses of OptiMusic for Children with Special Needs

Teach Basic Concepts

OptiMusic facilitates learning through the stimulation of the audio and visual senses. It compels the attention of the children to engage in the learning process. It can be used to introduce and teach basic language concepts in a more effective and interesting way. The concepts can range from the basics of colors, numbers and alphabets, to more complex concepts such as identifying and recognizing everyday sounds, animal sounds, musical sounds and festive songs. It helps the children in developing short term and long term memory, understanding high level thinking, and understanding daily life application of the concepts learnt.

Improve Understanding of Cause and Effect

With reflective items in place, the facilitator shows the children how to swipe their hand or make movements over the reflective items and listen to the sound produced from the system. Children can also wave the reflective item across the beam or hold it under the light to create sounds. Children can understand the concept of cause and effect, with the waving movement as the cause and the sounds/images as the effect. The facilitator plays an important role in encouraging the children to move the reflective items under the beams to discover the sounds.

Improve Fine and Gross Motor Skills

OptiMusic training is able to improve fine and gross motor skills, particularly hand-eye coordination. Children are required to wave or hold the reflective items under each beam to complete a song or sequence of sounds. Settings in the OptiMusic can improve the children's gross and fine motor skills when they are given the opportunity to do simple actions and dance to the music. Boxill & Chase (2007) suggested that functional use of fingers and hands can be trained by playing musical instruments and the repeated movements help to improve their motor control and coordination.

Improve Communication and Interaction

OptiMusic encourages children to play with the beams as a group, listening and responding to each other. Besides, they also learn to take turns with their friends. Group performance is great fun for the children to communicate and interact with other children. It promotes teamwork as the children work together harmoniously towards the performance and production of their own unique composition, by controlling when and how to combine the beams. OptiMusic encourages communicative behaviour of children with special needs through the unique nonverbal way of communication provided by the music.

Improve Musical Timing and Rhythm

OptiMusic provides children with the opportunity to explore different music speeds. They learn how to control their movements by playing a song with the correct timing and rhythm. Using familiar songs, children can be trained to play at the required speed consistently. When the accuracy of performance increases, the children develop an awareness of timing and rhythm, and develop confidence to perform.

Improve Audio-Visual Memory and Aural Sequencing

Children are encouraged to guess and identify the sounds from the light beams. They need to recall the sequencing of the sounds when matching the visual cards/real objects to them. Certain settings in the OptiMusic system can be used to improve children's aural sequencing. The setting has each beam programmed with a verse of a song. After each verse, there is a pause that prompts the children to move to the next beam to

continue and complete the song.

Methods

Setting Up the OptiMusic System

Setting up of the OptiMusic system follows the guidelines below.

Environment for OptiMusic

In order to create a safe and conducive environment for OptiMusic, there are a number of requirements that need to be met:

(a) A sturdy ceiling to install the OptiBeams.
(b) A floor surface that is light colored, such as off-white or light grey, to have clear differentiation of the beam colors.
(c) Blinds or drapes to shut out day light from the windows to enhance the visibility of the light beams.
(d) Other work lighting installed in the room should be controlled by a power switch. Lights with movement sensors are not advised to be installed in the room for OptiMusic. Lights with sensors are kept on all the time when there is movement detected and users will not be able to see the light beams clearly.
(e) A smoke machine is optional. The smoke helps to make the colored light beams more visible and can add a sense of mystery to the session.

Power switches

The OptiMusic system needs two power switches. One switch is for the lights and speakers, and the other is for the computer system. The facilitator needs to switch on both power switches to turn on the computer and the lights.

Hardware

(a) Computer or laptop with Windows XP or Vista and 1 gig Random Access Memory (RAM).
(b) Mouse to navigate through settings and select beams for editing in the system.
(c) Keyboard to type in or amend titles of settings or projects.
(d) Sound system to enhance the audio effect.

Software

Software includes the Play Screen and Edit Screen.

(a) Play Screen enables the user to load default settings and choose settings that are ready to play from the beams.
(b) Edit Screen displays the content of the settings and holds all the tools for editing and creating new settings. It contains the “Wave Event Editor”, “Note Event Editor”, “Image Event Editor” and “Video Event Editor”.
(c) “Wave Event Editor” is used to load or edit wave files. The wave files which are compatible with a Microsoft Windows system include sound effects, voices and music samples in Wave Audio File Format (WAV).
(d) “Note Event Editor” is used to create melody or chords from different instruments in the system.
(e) “Image Event Editor” is used to load picture files. The image can be projected on the projector screen when beams are played.
(f) “Video Event Editor” is used to load video into the setting.

List of Settings

All OptiMusic systems come with a suite of 51 default settings which can be easily selected using the Button Box or mouse. The settings have seven categories, such as instrumental, play a tune, creative play, activities, sound explorer, juke box and relaxation. The facilitator can also develop new settings by using the Edit Screen. All settings can be used to develop different skills depending on the theme or objective. The facilitator needs to decide on the settings to be used in each session, based on the participant’s mental ability and learning focus.

Setting the Play Modes

There are three Play Modes in the OptiMusic

system.

(a) On/Off Option (ON):
Choosing this option means the wave file will only play while the beam is being triggered. When a user comes out of the beam, the sound effect will stop. With each new trigger, the wave file will play from the beginning or go to the next event in the sequence, if more than one event is programmed.

(b) To End Option (TE):
Playing in this mode means the whole WAV file will play from beginning to end, ignoring repeated triggering whilst the wave file is playing. The beam does not have to be 'held on', a single trigger is sufficient for the wave file to play in its entirety.

(c) Loop Option (LP):
Choosing this option creates a continuous wave file. The wave file will play continuously when the beam is triggered. When the beam with the loop option is played, the user can play other beams simultaneously.

Setting Up the OptiMusic Program

When setting up the OptiMusic program, the following must be considered:

(1) Duration
- Duration recommended for each session is an hour.
- It is recommended to have the session once a week or fortnightly.

(2) Grouping
- Children are arranged into different groups according to their developmental age (not chronological age) in the receptive and expressive language domain, and mental domain.
- Recommended number of children for each group is 4 to 8 persons.

(3) Role of the Facilitator
- Suggested number of facilitators for each session is 1 to 2 persons.
- The facilitator needs to undergo training of OptiMusic where she/he learns to plan and conduct the session independently.
- The facilitator must be able to plan the activities and conduct sessions, according to the children's level, for six months.
- The facilitator must review the program every six months and revise the planning accordingly.

(4) Role of the Parent
- Parental involvement is encouraged and a parent can be seated behind his/her child.
- The parent needs to guide the child to follow the facilitator's instructions.
- The parent needs to provide feedback on the child's progress to the facilitator from time to time.
- The parent needs to manage the child's behavior during the session.

Materials

The materials below must be present:

(a) Reflective items
The facilitator has to ensure that the reflective items (OptiBats/OptiPads/OptiMits) are in good condition.

(b) Extra materials
Other than the reflective items, below are extra materials which can be used to enhance the children's learning during OptiMusic training:

i. Visual cards/real objects
To be effective, the facilitator needs to prepare visual cards or real objects according to the activities planned, in order to gain the children's attention and help them to have better understanding of the sounds.

ii. Colored and numbered cards
The facilitator can prepare colored cards that correspond to the beam's colors (minimum of 2 sets) and numbered cards

from 1 to 8 (minimum of 2 sets).

iii. Melody for nursery rhymes
Using the setting of "Do Re Mi 1", the facilitator can use the colored cards to teach children how to play the nursery rhymes. The colored cards represent the beams, which also represent the music notes (Do, Re, Mi, Fa, So, La Ti, Do). The facilitator can arrange the cards, according to the melody of the nursery rhyme, on a board. Children will need to wave the beam according to the card sequence, in order to play the nursery rhyme melody. The facilitator can exchange the colored cards with number cards in the same activity.

iv. Props
The facilitator can also prepare related props for festive themes or story telling sessions.

Procedure of the OptiMusic Program

Step I: Preparation before the Session

The facilitator switches on the OptiMusic system, arranges some soft mats (area for seating), prepares materials needed for each session, and then ensures that the children line up outside the room, count from 1-10, and then enter the room. Lastly, the facilitator ensures that the children sit on the mat quietly and wait for the session to begin.

Step II: Warm Up Exercises (10 minutes)

The facilitator gives the OptiBat to the children and shows them how to grasp and hold it and make waving movements with it. The facilitator also needs to ensure that the children's waving movements are confined to just one light beam. Exaggerated waving movements may trigger sounds from other beams, which may disrupt the song sequence. The facilitator calls out one child at a time, to explore the sounds from the light beams. The children will have an opportunity to understand the working of OptiMusic. The facilitator can implement turn-taking skills by having the child call out to the other children and pass them the OptiBat.

Step III: OptiMusic Session Start (40-45 minutes)

The facilitator runs this section according to the curriculum that has been planned for the children's mental ability. The first activity allows the children to explore different kinds of sounds according to the theme. If the children are able to recognize and identify all of the sounds, the facilitator may allow them to match the visual cards or real objects to the light beams that produce the corresponding sound. The second activity requires the children to work in groups of four. Each child will be assigned a beam to play with. Using the setting of "Play A Tune" (any beam play), the children wave the reflectors according to the tune. Each child can take turn to play one verse of the selected song to make a complete song. While one child plays the verse, the others can clap and sing along to encourage interaction.

Step IV: Final Activity (5-10 minutes)

To conclude the session, the facilitator conducts activities such as a sing along session, action songs or games related to the themes introduced. We can also add in relaxation time. Relaxation music is played and the children sit still or lie down to calm down. Finally, the children will line up and count from 10-1 before leaving the room.

Step V: Clean Up

The facilitator collects all the materials and the soft mat, ensures that the OptiMusic system is switched off, and that all of the materials are locked up in the cabinet and room.

Duration of time:	Procedure:	Choice of setting:	Skills to develop:
10 minutes	**Warm up exercise:** • Children hold the OptiBat and follow the facilitator's movements. • Children practice waving the OptiBat under the light beam with no sound. (Facilitator mutes the sound). • When children are able to control the waving movement, they can practice with the sound on.	03: Do Re Me 1	• Train listening & responding skills • Develop fine & gross motor skills • Develop coordination skills • Train turn taking • Improve concentration • Encourage group interaction • Introduce concepts of colors, numbers and farm animal sounds • Improve sense of timing and rhythm
20 minutes	**Main Activity:** **Play A Tune (Single note)** • Children take turns to come out and play with the beams. • Children may guess the sound produced. • The facilitator introduces the animals to the children. • The facilitator asks the children to match the visual card of the animal to the beam that produced the animal's sound.	35: Farm Sounds Cockerels Pig Cow Sheep Horse Geese Donkey Chicken	
20 minutes	Main Activity: Play A Tune (Multi notes) • Children are divided into 2 groups (4 children in a group). • One group comes forward and each child is assigned to a beam. • The group performs a song by taking turns. • The first child waves the OptiBat to play the first verse of the song. • The second child continues to play the second verse without delay. This continues until the group completes the song.	08: Happy Birthday Verse 1 Verse 2 Verse 3 Verse 4	

Duration of time:	Procedure:	Choice of setting:	Skills to develop:
	• When one child is playing the music, the other children in the group clap and sing along with the music.		
10 minutes	**Final Activity:** • The children have a sing-a-long session by singing the happy birthday song for those who are celebrating their birthday that month. • The facilitator instructs the children to lie down and listen to relaxation music.		

Implication

OptiMusic supports a holistic inclusive experience and the philosophy of active participation as a simple, creative and effective tool which stimulates and encourages interaction, communication and self-expression at every age and level. Further research is needed to determine the long-term effects of using OptiMusic to help develop skills amongst children with autism.

Through our experience, OptiMusic provides sensory experiences for the participants. We found that the children adapted and behaved well (reduced restless behavior, able to sit still and wait for their turn) and showed sensory improvement with a reduction in hypersensitivity to visual and audio stimuli. Therefore, this program suits special needs children with or without sensory challenges. OptiMusic has wide-ranging educational benefits, such as learning literacy and numeracy, music and drama. It can be conducted by a facilitator with or without a music background. With a wide variety of presets that support and cater for the demands of the curriculum, the teachers and facilitators can provide customized and focused sessions with clear learning goals. Teachers and facilitators must assess and evaluate the level, consistency and precision of the child's progress.

Recommendations

As mentioned earlier, the OptiMusic sessions depend on the creativity and experience of the facilitator. Here are some suggested activities for the session:

1. The facilitator repeats the same activity, two to three times, during a session. The repetition of activity allows children with special needs to have better understanding of the concepts implemented in the session.
2. As the planning lasts for six months, it is suggested that changes are made to meet the level of performance of the children from time to time.
3. The facilitator can create a simple story or drama for the children. Each child will be assigned a beam and they need to play with that beam when the facilitator mentions the specific sound in the story.
4. The facilitator can conduct the session based on a theme such as a birthday party, Halloween party or Christmas party. The children are required to wear costumes as part of the simulation training.

5. The facilitator can use the OptiMusic system to create action songs or dances for the children.
6. When the children are confident in playing OptiMusic, the facilitator can organize an orchestra performance where each child is assigned to one or two beams and they play together as a group to make a complete music piece.

Conclusions

In our experience, OptiMusic has positive effects on the behaviour; social skills; speech and language skills; and motor and coordination skills of children with autism. OptiMusic utilizes the combination of lights and sounds to train the children to explore and interact with them. They learn about cause and effect; explore and discover sounds; develop and strengthen their listening and responding skills; improve hand-eye coordination and body coordination; develop turn taking and social skills; and improve concentration and memory. They also have fun during the session and gain self-confidence when they perform with their team members in front of an audience.

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