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Using the MOGCLASS in Group Music Therapy With Individuals With Muscular Dystrophy: A Pilot Study

Wang Feng Ng, MMT, MT-BC[1], Yinsheng Zhou, BSc[2], Patsy Tan, PhD, MT-BC[3], and Ye Wang, PhD[2]

Abstract

This pilot study aims to survey muscular dystrophy (MD) clients' perception of enjoyment, motivation, and success during music therapy group sessions with the use of music assistive technology, Musical mObile Group for Classroom Learning And Study in Schools (MOGCLASS). Convenience sampling was used to recruit a total of 7 participants with MD and progressive muscle weakness. The study design comprised 3 sessions using acoustic musical instruments, followed by 3 sessions using MOGCLASS. Sessions were conducted by a board-certified music therapist. All other variables (eg, venue, session plans) were controlled throughout the study. Data were analyzed using repeated-measures analysis of varaince test. MOGCLASS achieved higher perceived enjoyment, success, and motivation, though the difference was not statistically significant, possibly due to the small sample size. Music therapy is appropriate and enjoyable for clients with MD. There is a great need for music therapy research for clients with MD, with emphasis on the use of assistive technology.

Keywords

assistive technology, muscular dystrophy, music therapy, networked mobile device

Introduction

Muscular Dystrophy

According to the National Institute of Neurological Disorders and Stroke (NINDS), muscular dystrophies (MDs) refer to "a group of more than 30 genetic diseases characterized by progressive weakness and degeneration of the skeletal muscles that control movement."[1] Muscular dystrophy is also characterized by muscle "wasting and contractures, that are usually progressive and sometimes life threatening."[2] Depending on the specific disease, the distribution, and extent of muscle weakness, the age of onset, rate of progression, and pattern of inheritance varies.[1] The most common is Duchenne muscular dystrophy (DMD), which "affects all voluntary muscles, and the heart and breathing muscles."[3] Other types of MD include Becker MD, facioscapulohumeral MD, and myotonic MD. There is presently no specific treatment to stop or reverse any form of MD though research is ongoing to "understand MD and to develop techniques to diagnose, treat, prevent, and ultimately cure the disorder."[1]

The incidence for MD varies, as some forms are more common than others. Its most common forms in children, Duchenne and Becker MD, alone affect approximately 1 in every 3500 to 5000 boys, or between 400 and 600 live male births each year in the United States.[4] There are no published statistics for Singapore's MD incidence, but according to extrapolation calculations, 6 to 8 per year were suggested, based on US, UK, Canada, and Australian statistics.[5,6]

Literature Review

Music Therapy and MD

From as early as the 1950s, music therapy has been seen as an appropriate treatment modality for individuals (particularly children) with MD.[7] Subsequently, occasional references have been made to MD in the music therapy literature, seeming to acknowledge that individuals with this diagnosis are helped by music therapy services, oftentimes in the same breath as other orthopedic impairments such as arthrogryposis and cerebral palsy.[8,9] More recent contributions were made by Kennedy and Kua-Walker[10] and Dwyer.[11] Both were case studies;

[1]Freelance Music Therapist
[2]Department of Computer Science, National University of Singapore, Singapore
[3]Department of Music and Creative Therapy, Singapore General Hospital, Singapore

Corresponding Author:
Patsy Tan, Department of Music and Creative Therapy, Singapore General Hospital, Sisters Quarters Level 2 Room A6, Outram Road, Singapore, 169608, Singapore
Email: patsy.tan.l.p@sgh.com.sg

Kennedy and Kua-Walker[10] examined whether skills worked on during music therapy sessions transferred over to regular classes, while Dwyer[11] explored the use of songwriting with an adolescent with MD. Hence, to date, researchers have not given much attention to music therapy work with individuals with MD and specifically work involving the use of technology.

Music therapy can meet the multifaceted needs of individuals with MD and various treatment domains have been articulated by authors,[12,13] for example, motor skills, communication skills, cognitive skills, social skills, emotional skills, and musical skills.[13] Some of the areas mentioned above apply more to children than to adults, due to the particular developmental needs of children.

Peters[12] highlighted the need for individuals with MD to be encouraged to exercise regularly to maintain or improve physical functioning. Movement to music and movement through music, for example, playing instruments, can help strengthen or maintain muscle tone, range of motion, and coordination. Moreover, as individuals with MD may have been excluded from various social activities due to their lack of or restricted mobility, they may need to seek out meaningful social experiences to decrease isolation, improve their social skills and boost their self-confidence, and build/restore their self-esteem. Indeed, Korson Herman[7] pointed out that the child with MD usually lacked independence and confidence as a result of overprotective parents and hence tends to become inactive and lose interest in work and play. Musical activities (eg, participating in a music group) can invite individuals with MD to make contact with others.

Indeed, due to their restricted physical functioning, individuals with MD cannot use strenuous physical activity to vent their frustration and release tension.[12] Therapeutic music experiences also can offer a medium through which their emotional needs may be met. It is important to recognize that individuals with MD have needs common to their nonimpaired peers, including needs of independence, a feeling of accomplishment, opportunities to participate with others in meaningful activities, enjoyable leisure and recreational experience. In particular, they may have a greater need for opportunities for aesthetic experience and expression as they seek ways to add meaning, fulfillment, and quality experiences to their lives.[12] The development of musical skills can also have a normalizing effect.[13]

Use of Technology With Clients With MD

Though there is some literature about the use of technology in music therapy literature,[14,15] there is limited research focus on clients with MD. The use of technology with individuals with MD is also a relatively unexplored area, but one that has massive implications for the MD client's success in the music-making experience.

Traditional musical instruments often need to be adapted to make for successful participation in the music-making by clients. For example, instruments may be mounted on wheelchairs or tray tables to make them more accessible to wheelchair-bound clients. Manuals also provide advice regarding the basic physical abilities required to play various instruments and inform therapists to make appropriate instrument selection for individuals with various abilities.[12] However, certain instruments would be difficult for a client with very weak muscular control and strength to manipulate without adaptation, such as the tone chimes. Such is where technology can offer solutions.

Assistive Technology

Indeed, music therapists may often encounter assistive technology (AT) in their work serving a wide range of client populations with unique needs. A broad definition of AT is "the use of devices and services to help people with disabilities of all ages in their daily lives."[16] Such devices include but are not limited to computer technology, and also the approaches and methodologies that accompany the technology.[17] As clients with physical limitations often have limited ways of expressing themselves musically, the use of technology can make the music-making experience more accessible and direct[18] as well as increasing the width of the client's musical expression.[19]

Generally, 2 kinds of technology have been applied in music therapy to facilitate client participation: nondigital and digital. There exists a myriad of applications of nondigital technology used by music therapists and their clients, usually involving some modification of traditional instruments. Indeed, the adaptation of acoustic instruments for therapeutic use has been driven not only by client needs but also by the creativity of music therapists.[20] However, musical improvisation with acoustic instruments remains a challenge, and this causes frustration for therapists trying to make available to their clients a wide range of possibilities in musical interaction.[21] Even the theremin could potentially be explored for use with clients with physical limitations as there is nothing to hit or hold, though it may pose other challenges for clients who are not able to maintain their hand position in air for a sustained period. (The theremin is an electronic instrument consisting of 2 metal antennas; its sounds are controlled by the positioning of the player's hands.) Technological applications in music therapy may be more difficult to apply since not only music therapists and clients, but also designers and engineers of music technology, should be involved in the process. It is also noted that music therapists have been using technology that does not require specialized expertise in their work with individuals with less complex needs, for example, amplification and recording devices.[19]

Digital music technology applications that are useful for music therapy are summarized as follows.

In Toy Symphony,[22] beatbugs are handheld percussive instruments that allow the creation, manipulation, and sharing of rhythmic motives through a simple interface. Meanwhile, multiple beatbugs can be connected in the network to form a larger scale collaborative composition. Music shapers are soft, squeezable instruments allowing players to mold, transform, and explore musical material and compositions. Music shapers allow access to high-level parameters, for example, contour,

timbre, density, and structure. In the drum machines,[23] percussion accompaniment is generated to the playing and/or singing of a song that has the following benefits: (1) developing aural acuity and recognition of different percussion sounds; (2) recognizing beat patterns, developing an awareness for loud/soft concepts on a machine with velocity-sensitive pads; (3) programming beats to match current rap/pop/rock songs; improving eye–hand and fine motor coordination.

MIDICreator[24] creates an array of innovative switches that allow clients to control a variety of sound choices as a result of simple physical actions and gestures. There are 2 additional devices MidiGesture and MidiSensor that detect body movement in either individual or group settings. MidiGrid[24] is a program that controls MIDI synthesizers and tone cards/modules via a unique system of on-screen boxes arranged on user-designed grids. It organizes complex sound relationships graphically in boxes and then organizes these boxes visually on an on-screen grid. It is possible to use MidiCreator to play the compositions and sounds programmed in MidiGrid.

In the United States, legislation provides for the availability of AT to individuals with disabilities and their families. AT "may be provided as part of special education, as a related service, or as a supplementary service."[16] In Singapore, the Ministry of Education has provided the FM system, a wireless assistive hearing equipment, to hearing-impaired students since 1999.[25] In 2000, visually handicapped pupils (in designated secondary schools) were equipped with assistive devices such as Braille Notebook Computers, talking calculators, voice synthesizers, and specialized computer software.[26] The Ministry of Community Development and Sports (now Ministry of Community Development, Youth and Sports) "launched the Assistive Technology Fund aimed to help individuals purchase the assistive equipment necessary for employment and educational purposes."[25]

Although AT has helped individuals with various disabilities, not many studies have been conducted with the MD population. Thus, the purpose of this pilot study is to survey MD clients' perception of enjoyment, motivation, and success during music therapy group sessions with the use of music AT, Musical mObile Group for Classroom Learning And Study in Schools (MOGCLASS).

Research Hypotheses

The following research hypotheses were established for the purpose of this study:

Hypothesis 1: Participants have greater perception of enjoyment in group music therapy sessions using MOGCLASS.
Hypothesis 2: Participants have greater perception of success in group music therapy sessions using MOGCLASS.
Hypothesis 3: Participants have higher motivation level in group music therapy sessions using MOGCLASS.

Method

Participants

Convenience sampling was used to recruit a total of 7 participants attending regular music therapy group at a nonprofit community organization serving individuals with MD and progressive muscle weakness. The participants were aged 14 to 29 years and wheelchair bound. All except 1 of the 7 participants had DMD, and all required help with positioning of instruments. Upon getting approval from the organization's management committee (as there was no ethics committee that could grant study approval for nonhospital-/university-based participants), all participants and their parents or guardians (as applicable) were informed about the study protocol and the 2 conditions (traditional acoustic instruments and MOGCLASS) and were given the opportunity to ask questions. Participation in the study was voluntary and participants were assured that they were able to withdraw from the study at any time, with no consequences.

Study Design and Procedure

The current study was a within-participant design study, with acoustic musical instruments condition and MOGCLASS condition. The study comprised 3 sessions using acoustic musical instruments, followed by 3 sessions using MOGCLASS. All other variables such as therapists, MOGCLASS developer, room where sessions were conducted, session plans, and session duration were controlled throughout the study. The 6-session program was implemented by a board-certified music therapist.

Questionnaire design. Two survey forms were created for the purpose of this study. Form A focused on participants' background so as to have a better understanding of their exposure to technology and musical training. The second questionnaire, Form B, was created to evaluate participants' perception of success, motivation, and enjoyment in both study conditions during music therapy group session. The items on the questionnaire were created by modifying some of existing questionnaire questions.[27] Kwang's[27] study was used as it examined children's motivation for engaging in instrumental music activity. Individuals with MD need to exercise to maintain their physical functioning. Hence, motivation to exercise and to stay engaged in meaningful activity for as long as they can is a key element in their well-being. They are more likely than normally developing peers to have been excluded from various social activities due to their condition, thus they have great need to engage in meaningful social interaction to boost confidence and improve quality of life.[12] Questions related to perceived success and enjoyment of the group experience were also added, to explore any further trends that may emerge. Participants circled a number in response to each statement. The response spectrum was labeled *strongly disagree* on one end and the other *strongly agree*, with numbers 1 through 7, like a 7-point Likert-type scale.

Table 1. Analysis of Second Form B Results: 1-Way ANOVA Test[a]

Statements on Form B		Method	Mean	Std Error	$F_{1, 6}$	*P*
1. Interesting to play	Motivation	1	4.833	0.345	2.359	.175
		2	5.583	0.345		
2. Easy to play	Motivation	1	5.000	0.177	1.000	.356
		2	5.250	0.177		
3. Like to play during free time	Motivation	1	4.417	0.622	0.144	.718
		2	4.750	0.622		
4. Want to play to learn/practice new skills	Motivation	1	5.250	0.440	0.018	.898
		2	5.167	0.440		
5. Want to play to learn/practice new musical pieces	Motivation	1	5.083	0.325	1.615	.251
		2	5.667	0.325		
6. Enjoy playing in the group	Enjoyment	1	6.000	0.450	1.111	.332
		2	5.400	0.349		
7. Enjoy performing for others	Enjoyment	1	4.583	0.542	0.047	.835
		2	4.750	0.542		
8. Feel successful playing in the group	Perceived success	1	4.833	0.659	0.072	.797
		2	5.083	0.659		
9. Feel personal contribution is important to the group's success	Perceived success	1	5.000	0.553	0.378	.561
		2	5.556	0.714		

Abbreviations: MOGCLASS, Musical mObile Group for Classroom Learning And Study in Schools; ANOVA, analysis of variance.
[a]Methods 1 and 2 are traditional music instruments and MOGCLASS, respectively.

All participants were required to complete Forms A and B. Form A was administered before the commencement of the study, and Form B was administered at the end of each session. One of the investigators who did not conduct the session was present to clarify any questions during this process, so as to minimize contamination of the data.

Acoustic musical instruments and MOGCLASS setup. Various acoustic musical instruments were used during the session, for example, tambourines with skin head, small djembe (drum from Western part of Africa), ocean drum, chimes on stand, cymbal on stand, cabasa, multitone drum, wrist bells, small and regular shakers/maracas, handbells, agogo bell, and triangle. Most of the instruments were played using mallets.

The MOGCLASS consists of a set of networked mobile devices as music controller, several laptops as servers for sound generation, and loud speakers for playing the sound aloud in order to overcome the problem of insufficient volume of the speakers within mobile devices. The handheld component for the user weighs 115 g (4.1 oz). The interfaces of MOGCLASS include hitter, tapper, and slider. The hitter interface mimics the drums to support users' body percussion; the tapper simulates xylophones or mallet instruments; and the slider represents violins. The design of the user interface in MOGCLASS originates from the music curriculum of local primary schools.

However, in order to support MD clients' music performance, the interfaces had to be redesigned according to their specific characteristics. For example, the sensitivity of hitter interface was changed to match the participants' weaker hand strength. In addition, the number of buttons in the tapper interface was changed from 12 to 1 large button, which participants could trigger by touching almost anywhere on the screen. The sounds installed in MOGCLASS included percussion sounds and pitch-based sounds. For percussion sounds, there were bass drum, snare drum, high hat, crash cymbal, cowbell, cabasa, and other sounds. For pitch-based sounds, there were marimba and other sounds.

Session plan. Each session, lasting 30 minutes, involved a familiar routine that included breathing exercises, physical warm-up exercises (involving movements from head to toe), a rhythm band activity, and either a structured percussion exercise or a melodic activity.

Results

Only 4 participants attended all 6 sessions. Three missed at least 1 session due to medical appointments or extenuating circumstances, and their data were not included in the analysis. Participants who attended all sessions (n = 4) had the diagnosis of DMD. Data collected were analyzed using the repeated-measures analysis of variance (ANOVA) test; the instrument was the between-participant factor. Table 1 and Figure 1 summarize the results of Form B.

Based on the results, it is not definitive that MOGCLASS led to a higher level of perceived enjoyment (Hypothesis 1). The use of MOGCLASS garnered higher levels of success reported by participants, though not significantly higher (Hypothesis 2). Finally, the use of MOGCLASS did not consistently lead to higher levels of motivation (Hypothesis 3).

Discussion

For 7 out of 9 questions, MOGCLASS rated higher than traditional instruments, though the difference was not statistically significant. Specific findings follow: Participants found it more interesting (5.583 vs 4.833) and easier to play (5.25 vs 5.00). Participants also liked to play MOGCLASS during their

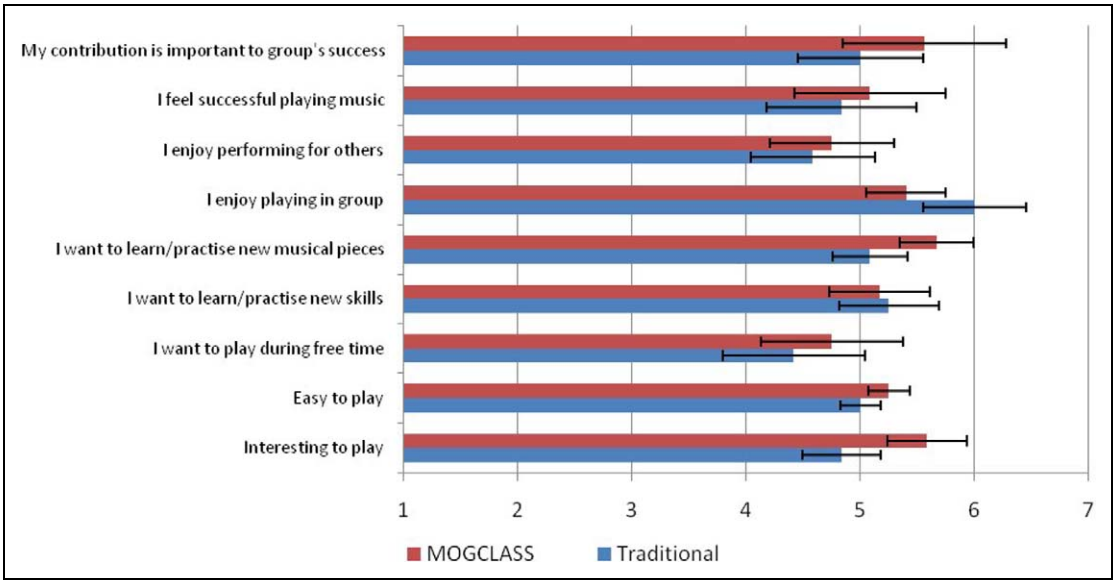

Figure 1. Data from Form B

free time more than traditional instruments (4.75 vs 4.42), and they wanted to learn or practice new musical pieces using MOGCLASS more (5.67 vs 5.08). They also enjoyed performing music for others using MOGCLASS more (4.83 vs 4.75) and perceived more success using MOGCLASS than traditional musical instruments (5.08 vs 4.83). Finally, they felt that their contribution to the group was important using MOGCLASS compared to traditional instruments (5.56 vs 5.00). The higher rating for MOGCLASS may be due to the relative ease with which sounds were made, as the device's sensitivity was adapted to match the participant's physical ability. Hence, with a light shake or touch, the participants made sounds and were able to make loud sounds (as volume was also set by the designer). Participants also asked for MOGCLASS the session after study was completed, demonstrating some continued interest.

For questions 4 and 6 (wanting to learn or practice new skills using and enjoyment of playing in the group, respectively), participants rated traditional musical instruments higher than MOGCLASS. A few possible reasons include skill required to make a sound with MOGCLASS was limited to tapping on the screen or shaking the device—which though simple, could be experienced as being boring and unrealistic. Participants commented that while traditional instruments produce different sounds when played a different way, such as with a different angle or impact of contact, the MOGCLASS sounded always the same no matter how it was shook or tapped on. This created a 1-dimensional sound that discerning users may notice and hence derive less enjoyment. Also, traditional musical instruments provide instantaneous auditory and vibrotactile feedback, while MOGCLASS produced the only auditory feedback from the same loud speaker. As there was a slight delay in the sound, it made it more difficult for participants to locate their own sound/sounds. Finally, participants also commented that MOGCLASS was heavy, which taxed their already weak muscular strength. Also, participants may have been more worried not to drop MOGCLASS and hence concentrated more on not losing grip on it, therefore reporting a lower level of enjoyment.

Lastly, data were also compared from session to session in the traditional instrument condition to detect trends. The marked improvement for statement 2 shows that after adjusting the interfaces, MOGCLASS was easier to play.

It is also worth noting that the general rating of perceived enjoyment, motivation, and success for both conditions were high—participants agreed that they enjoyed making music in the group, felt successful, and were motivated to learn or practice new skills using musical instruments/MOGCLASS. This demonstrates that the participants were enjoying group music therapy sessions. The highest score was for enjoyment of making music in the group for the traditional musical instrument condition. Playing musical instruments as a way to maintain hand strength and range of motion is very motivating and enjoyable particularly in the group setting. This lends support to the long-held belief that music therapy is appropriate and enjoyable for clients with MD, in this case, group music therapy sessions.

Limitations and Recommendations

There is a great need for music therapy research with MD clients, with particular emphasis on the use of AT. This study, while attempting to fill a significant void, was faced with a number of limitations. The sample size was very small. A bigger scale study would give a clearer indication of the preferences of clients with MD. Technical requirements of MOGCLASS also presented challenges. In the first MOGCLASS session, the devices were not yet fine-tuned to match the participants' ability; hence, the MOGCLASS condition was not held constant, as opposed to traditional instruments

that did not require any fine-tuning. Finally, in choosing traditional musical instruments, participants tended to choose instruments with which they had experienced prior success, while MOGCLASS was a new experience for them, and the device was identical, it was not possible to make adaptations (eg, so that they had a more secure grip), given existing time and resource constraints. Perhaps future improvements can reduce the weight of the device from the present 115 g, add some variations in the type of sounds produced according to the way it was shaken or tapped, and further shorten the time lag between movement and auditory output. In addition, participants could use individual earpieces to locate their own sounds with ease.

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References

1. Muscular Dystrophy Information Page. National Institute of Neurological Disorders and Stroke website. http://www.ninds.nih.gov/disorders/md/md.htm. Accessed June 21, 2010.
2. About Muscular Dystrophy Page. Muscular Dystrophy Association website. http://www.mdas.org.sg/index.php?option=com_content&view=article&id=8&Itemid=10. Accessed May 24, 2011.
3. Duchenne Muscular Dystrophy Page. Muscular Dystrophy Association website. http://www.mda.org/disease/dmd.html. Accessed June 21, 2010.
4. Muscular Dystrophy: Hope Through Research Page. National Institute of Neurological Disorders and Stroke website. http://www.ninds.nih.gov/disorders/md/detail_md.htm. Accessed June 21, 2010.
5. Statistics by country for muscular dystrophy Page. Health Grades, Inc., http://www.cureresearch.com/m/musdys/stats-country.htm. Accessed June 21, 2010.
6. Statistics by country for muscular dystrophy Page. Health Grades, Inc., http://www.wrongdiagnosis.com/m/musdys/stats-country.htm. Accessed June 21, 2010.
7. Korson Herman F. Music therapy for children hospitalized with muscular dystrophy. In: Gaston ET, ed. *Music in Therapy*. New York, NY: Macmillan; 1968.
8. Bonny HL. Music and healing. *Music Ther*.1986;6A(1):3-12.
9. Krout R. Music therapy with multi-handicapped students: individualizing treatment within a group setting. *J Music Ther*. 1987; 24(1):2-13.
10. Kennedy R, Kua-Walker YA. Movement, singing, and instrument playing strategies for a child with myotonic dystrophy. *Music Ther Persp*. 2006;24(1):39-51.
11. Dwyer O. Would you like to write your own song? page. *Voices: A World Forum for Music Therapy* website. 2007. https://normt.uib.no/index.php/voices/article/viewArticle/494/401. Accessed June 30, 2012.
12. Peters JS. *Music Therapy: An Introduction*. 2nd ed. Springfield, IL: Charles C Thomas Publisher Ltd; 2000.
13. Thaut MH. Music therapy for children with physical disabilities. In: Davis WB, Gfeller KE, Thaut MH, eds. *An Introduction to Music Therapy: Theory and Practice*. Boston, MA: McGraw-Hill; 1999.
14. Nagler JC, Lee MHM. Music therapy using computer music technology. In: Lee MHM, ed. *Rehabilitation, Music, and Human Wellbeing*. St. Louis, MO: MMB Music; 1989:226-241.
15. Spitzer S. Computers and music therapy: An integrated approach. Four case studies. *Music Ther Perspect*. 1989;7:51-54.
16. Johnson FL. Integrating technology. *Music Ther Persp*. 1995; 13(2):7-8.
17. Johnson FL. Integrating technology. *Music Ther Persp*. 1997; 15(1):9-10.
18. Johnson FL. Integrating technology. *Music Ther Persp*. 1996; 14(2):7-8.
19. Magee WL, Burland K. Using electronic music technologies in music therapy: Opportunities, limitations and clinical indicators. *British J Music Ther*. 2008;22(1):3-15.
20. Saggese A Jr. 2003. *Bringing Music Technology to Music Therapy: Using MAX/MSP as a Therapeutic Agent*. [master's dissertation]. New York, NY: New York University. http://www.theanthill.com/. Accessed December 1, 2010.
21. Nagler JC. *A qualitative study of children in crisis: Interventions through music therapy and digital music technology* [doctoral dissertation]. New York, NY: New York University; 1993.
22. Toy Symphony Music toys. http://www.toysymphony.net/. Accessed November 20, 2010.
23. Krout R. Integrating technology. *J Music Ther*. 1992;10(1):8-9.
24. Krout R. Integrating technology. *J Music Therr*. 1995;13(1):5-6.
25. Forum letter replies: Forum topic: Support for the hearing-impaired page. Ministry of Education website. http://www.moe.gov.sg/media/forum/2004/13022004.htm. Accessed June 22, 2010.
26. Speeches: Speech by Dr Aline Wong page. Ministry of Education website. http://moe.gov.sg/media/speeches/2001/sp28032001.htm. Accessed June 22, 2010.
27. Kwang SY. Exploring children's motivation for instrumental music. Paper presented at the biennial meeting of the Society for Research in Child Development; April, 1997; Washington, DC.

Bios

Wang Feng Ng, MMT, MT-BC, is a freelance music therapist.

Yinsheng Zhou, BSc, is a PhD candidate, Department of Computer Science at National University of Singapore, Singapore.

Patsy Tan, PhD, MT-BC, is a senior music therapist, Department of Music and Creative Therapy at Singapore General Hospital, Singapore.

Ye Wang, PhD, is an associate professor, Department of Computer Science at National University of Singapore, Singapore.