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Effects of Music Therapy on Students with Disabilities in South Korea: A Meta-Analysis

Yeji An[1] · **Dongil Kim**[2]

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Abstract This study examined the effects of music therapy interventions to establish evidence-based practice for students with disabilities. The study employed a meta-analysis, which allows not only to synthesize the effect sizes of accumulated data but also to draw substantive implications for the research field. A total of 23 studies with 118 effect sizes were analyzed by using HLM with a two-level model. The results demonstrate very large effects of music therapy interventions on students with disabilities (overall ES = 1.072). These promising results were consistently observed across all variables, with no significance except grade level and music therapy type. The study quantitatively examined music therapy for students with disabilities to facilitate provision of evidence-based practice through a related service in the field of special education in South Korea. Limitations of this study and implications for further research are also discussed.

Keywords music therapy · students with disabilities · meta-analysis · evidence-based practice

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✉ Yeji An
yan13@snu.ac.kr

[1] Ph.D. Candidate, Department of Education. Seoul National University
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[2] Professor. Department of Education. Seoul National University

Introduction

In 2007, the Special Education Law for Persons with Disabilities and Others (SELPDO) came into effect in Korea. The law was intended to serve students with all types of disabilities in an inclusive classroom environment to ensure the individuals' quality of life, and it resulted in an increase in special education services in public education. According to the Annual Report of Korean Special Education (2017), the number of students who were eligible for special education in 2007 was 65,940; this gradually increased to 89,353 in 2017. In fact, there has been an increased need for an inclusive education environment that is flexible enough to serve students with special needs, as well as a need to offer related services, such as therapy (Kim, Yu, & Baek, 2009). As a result of the increased responsibilities outlined in the law, however, teachers now often face the burdensome task of devising an individualized instruction plan that fits everyone's needs (Kim, Kim, Choi, & Kwon, 2011; Kim, Park, & Kim, 2009; Mastropieri & Scruggs, 2010). To address this challenge, related services have taken an important place in inclusive education.

Related services are defined as extra support for individuals with disabilities in their area of need to improve the efficiency of special education. These services include counseling, family, therapeutic, assistive technology, and transportation supports but are not limited to these services. In other words, any services that are required to maximize students' learning in special education are considered related services (Turnbull & Turnbull, 1978). Of these various supports, more than 50% of the students with disabilities are receiving therapeutic support, and there is still a high demand (Special Education Survey, 2014). According to Cho (2010), who conducted an analysis of needs on parents of students with disabilities who are subject to special education‐related services, the needs were concentrated on therapeutic support (60.7%). This stated high need for therapeutic support is often attributed to the unavailability of therapy services tailored to the students' needs, as therapeutic education was removed from the special education curriculum in 2013 (Jo, 2010; Kim, Kim, & Kang, 2015). Therapeutic support has accordingly expanded in quantity, but various problems have been pointed out as a result. In particular, the voucher system that is most commonly used for providing therapeutic support is mentioned as being problematic.

The voucher system has the advantage of allowing the selection and receipt of therapeutic support from institutions that have programs and facilities that meet the individual's needs. However, the treatment support determined by the preference of the user may be criticized as concentrating service users in specific institutions or as being a burden in terms of transportation time and cost due to the distant location of the facility (Choi, Han, & Nam, 2013; Pyo, 2013). These regional differences may cause a change in the quantity as well as the quality of the service, making it difficult to provide effective therapeutic support to students with disabilities. Moreover, numerous options in terms of supply-side market competitiveness and consumption should be a premise for the success of the voucher system (Belfield & Levin, 2002). The area of therapeutic support, however, is generally limited to speech/language, physical, and occupational therapy. This can be attributed to SELPDO, which clarifies therapeutic support as "physical therapy and occupational therapy, etc.," but it is also an obstacle to the efficient and successful operation of the voucher system. In summary, specific plans should be devised to counteract the local disadvantages of the voucher system, which is mostly used for therapeutic support,

and to make effective changes. An evidence-based practice of therapeutic programs that can be applied anywhere, regardless of regional differences, to expand and ensure the diversity of treatment support needs to be developed.

The attention to and demand for music therapy has recently increased in the area of therapeutic support. Music therapy is defined as the scientific application of music to achieve therapeutic goals for an individual's physical, emotional, cognitive, and social needs (Davis, Gfeller, & Thaut, 1999; American Music Therapy Association, 2018). Although a high number of students with disabilities have received music therapy, parents still reported that their greatest need was for additional music therapy programs (Jo, 2010). A review of early literature related to music therapy reveals that the growing body of research involving students with disabilities also provides evidence for the utility of music in special education (i.e., Cho, 2013; Chung, 2001; Hwang & Park, 2006; Park, 2012; Park & Hwang, 2006; Shin, 2005). Many studies have been carried out showing the positive results of music therapy in the emotional, social, and cognitive-behavioral domains, which are emphasized as special education evolves into a paradigm of inclusive education (Cho, 2013; Hwang & Park, 2006; Park, 2012; Park & Hwang, 2006). An individual's emotional, social, and cognitive-behavioral characteristics have high correlations with and play an important role in education. Music can help students with disabilities to earn a sense of control over their emotions by using music as a stimulus. This is because music can function as a nonverbal communication tool which provides a safe environment in which to explore an individual's emotions (Duerksen & Darrow, 1991; Gfeller & Thaut, 2008; Sausser & Waller, 2006). Various music activities allow students to project their feelings effectively through music, which will have an influence on overall positive behavioral change, such as self-awareness, socialization, and motivation in academic learning (Cho, 2009; Gold, Voracek, & Wigram, 2004; Hwang & Park, 2006; Standley, 1996). Resolving behavioral problems (e.g., attention span, on-task behavior, sitting behavior, following directions) can lead to enhancement of students' academic achievement (Cardarelli, 2003), especially in reading and mathematics skills (McLelland, 2005). The results of the studies mentioned above show that music therapy can be considered to be an effective form of therapeutic support to enhance the efficiency of special education and to provide the best possible educational and therapeutic effect.

The various attributes of music make it easy to create an intervention plan that fits the unique needs and environments of the individual. This flexibility of intervention, however, can be too subjective and heterogeneous to be generalized. For the qualitative development of music therapy, a review of all interventions is important to create an evidence-based practice that is appropriate for individuals with special needs. An evidence-based practice is (a) developed according to a manual or a set of guidelines or through a standardized and accredited training, (b) uncovered through a controlled study, (c) formulated using an objective measurement tool, or (d) replicated on the basis of previous studies by other researchers (Hood, 2003). To establish an evidence-based, systematic review of intervention, elements such as participants, interventions, and dependent variables need to be considered. One of the most effective methods for developing an evidence-based practice is a meta-analysis. Meta-analysis is a statistical procedure that uses mathematical formulas to prove the effects of interventions and to draw objective and transparent results while synthesizing available interventions (Borenstein, Hedges, Higgins, & Rothstein, 2009). Meta-analysis was developed by Glass (1976) to supplement the shortcomings of traditional methodologies, which provided results that required qualitative interpretation. The

methodology was criticized for ignoring the effect of moderator variables and interactions, and the results were deemed to be oversimplified. Notwithstanding such criticism, meta-analysis has been extensively used to synthesize the accumulated research and to prove its effects in behavioral science, social science, health science, and many other fields (Oh, 2007).

Reviews of the prior literature in the field of music therapy have revealed that meta-analyses have primarily examined music therapy from a medical perspective in dental/medical treatment (Standley, 1986), dementia treatment (Brotons, Koger, & Pickett-Cooper, 1997; Kim, 2014), education/therapy objectives (Kang, 2013; Standley, 1996), premature infants (Standley, 2002), pediatrics (Choi, 2009; Standley & Whipple, 2003; Whipple, 2004), and psychiatric populations (Gold, Voracek, & Wigram, 2004; Jung, 2011; Silverman, 2003; Son, 2013). Although the need for music therapy is increasing in the field of special education in South Korea, no meta-analysis has yet evaluated the effects of music therapy interventions for school-aged populations under the definition of educational laws since music therapy was included as a related service. Thus, the purpose of this study is to conduct a meta-analysis of music therapy interventions for students aged seven to 18 years labeled with disabilities under SELPDO to calculate the overall effects of music therapy and to form an evidence-based practice.

Research questions

This study aimed to quantify the diverse results of research on the effectiveness of music therapy for students with disabilities and to use meta-analysis to identify the critical variables that influence the effect size of interventions. To this end, this study will synthesize quantitative research in the music therapy literature and categorize the research in terms of student-related, intervention-related, and implementation-related (group size) factors and dependent variables to compute overall effect sizes to identify evidence-based practices. The specific research questions are as follows:

Question 1. What is the estimated mean effect size of music therapy for students with disabilities?

Question 2. To what extent do student-related, intervention-related, and implementation-related factors and dependent variables determine the effectiveness of music therapy for students with disabilities?

Method

Meta-analysis allows us to synthesize the effect sizes of accumulated data and to understand the variance of the true effects using heterogeneity, which allows us to identify substantive implications (Borenstein et al., 2009). The meta-analysis was conducted through three primary steps, suggested by Glass (1976), to answer the research questions. First, a literature review was completed to locate all possible sources, including both published and unpublished literature, to reduce the publication bias that can be created when only published results are analyzed. Second, the characteristics of the located studies were identified and categorized. Finally, we used statistical techniques to compute comparable effect sizes.

Data collection

A systematic literature search was undertaken using computer and hand-search methods. The databases were searched for the terms "music therapy," "disability," "students," "adolescents," and other relevant terms. The search databases included the Research Information Sharing Service (RISS), Korean Studies Information Service System (KISS), Nurimedia DBpia, and Google Scholar. The hand-searched journals included *Korean Journal of Music Therapy*, *Journal of Arts Psychotherapy*, and Journal of Arts Psychotherapy. Additional studies were identified from the reference lists of the included studies.

Because this study aimed to identify the overall effects of music therapy on students with disabilities, the publication period was not limited. Among the identified studies, only the studies that met all criteria and had full-text accessibility were included in the analysis. The criteria for inclusion and exclusion in this meta-analysis were as follows: First, the participants were students who were diagnosed with the disabilities listed in SELPDO (2007), which include visual impairment, hearing impairment, mental retardation, physical disabilities, behavioral and emotional disorders, autism spectrum disorders, communication disorders, learning disabilities, health impairment, developmental delay, and other disorders named in the Presidential Decree. Second, the participants were limited to school-aged children from seven to 18 years of age. Studies that included participants with ages outside the stated range were excluded. Third, quantitative studies (i.e., experimental and quasi-experimental) that provided sufficient information to extract an effect size were included. Fourth, studies that implemented music elements as interventions were excluded. Only studies that consisted of interventions designed by music therapists were deemed credible, even if the term "music therapy" was not stated in the title. Twenty-three studies were identified to meet all of the eligibility criteria mentioned above.

Data analysis

Hierarchical linear modeling (HLM) was employed to systematically explain the variation across studies for experimental group studies. Twenty-three one-group pretest-posttest design and pretest-posttest control group design studies were included for multilevel meta-analysis. Researchers have argued about whether to combine effect sizes that are computed from different study designs. According to Borenstein et al. (2009), different types of study designs can be combined in a single systematic review because as long as the study does not have statistical problems, effect size has the same meaning regardless of the study design.

Coding procedures

Student-related variables

In order to investigate the effect of music therapy intervention according to age, the participants were divided into (a) primary (elementary), (b) secondary (middle/high), and (c) mixed-grades groups. The study included disabilities that are listed in SELPDO (2007). The disability types included in the analysis were classified into four different groups that were revised from the

classification criteria used in Gold, Voracek, and Wigram's (2004) study. The revised classification criteria for disabilities in this study are (a) behavioral disorders, (b) developmental disorders, (c) physical disorders, and (d) multiple disorders.

Intervention-related variables

Music therapy has numerous models that vary according to its application. Unfortunately, the majority of music therapy studies do not identify the specific approach and apply eclectic music therapy instead. (a) Eclectic music therapy can be defined as music interventions using more than one music therapy approach. This makes it hard to categorize music therapy studies by type of model. An alternative way of categorizing music therapy is active versus receptive (Jung, 2005; Hwang, 2012; Gold et al., 2004; Bruscia, 1998, Montello & Coons, 1998). (b) Active music therapy is when the clients participate in music-making activities. A music therapist who implements active music therapy usually uses techniques like imitating (e.g., imitating a rhythmic pattern or melody that was created by the client), synchronizing (e.g., the music therapist and the client play the same music at the same time), reflecting (e.g., the client reflects his/her attitudes, moods, and feelings through music), and incorporating (e.g., using the client's own musical motifs as part of the music). These techniques can be applied to numerous musical activities such as singing, composing, improvising, and playing instruments. (c) Receptive music therapy is when the client listens to music that was selected under the "iso-principle," which will lead the client to gain therapeutic outcomes. Iso-principle is a technique that uses music to match the client's physical, emotional, and mental state and guide the client to express their feelings at a conscious or unconscious level (Bruscia, 1998). For instance, the therapist can choose a song which contains appropriate musical components and lyrics that can possibly guide the client to naturally share their thoughts and feelings.

Implementation-related variables

Music therapy interventions can be delivered to students individually, in a small group, or in a large group depending on the goal of the therapy. Designing an intervention environment in accordance with the needs of students with disabilities can determine the effect of the music therapy. Various researchers have used different criteria for defining group size. Therefore, this study followed the standard that is often used in the educational setting: (a) individual, (b) small group, (c) large group (Vaughn & Bos, 2011). The studies consisting of one participant or an individualized intervention setting are categorized as "individual," those with more than two but fewer than six participants were categorized as "small group," and those consisting of more than six participants were labeled as "large group."

Dependent variables

Music therapy interventions are designed to match the individual's specific needs. The same music therapy technique can be modified and applied to achieve many other therapeutic goals in a totally different form. Therefore, it is necessary to investigate the moderating effects of dependent variables on the grand mean effect size of music therapy interventions. Based on the

previous literature, dependent variables were selected and modified as (a) emotional, (b) social, and (c) cognitive-behavioral aims.

Effect size computation

Cohen's *d* was used as an effect size index in this study (Cooper & Hedges, 1994). This value requires statistical information regarding the control and treatment groups' means and standard deviations and the number of participants. With this information, effect size can be calculated as the mean of the treatment group minus the mean of the control group divided by the pooled standard deviation. The pooled standard deviation can be calculated using the following equation:

$$SD_{pooled} = \sqrt{\frac{SD_{1^2}(n_1 - 1) + SD_{2^2}(n_2 - 1)}{n_1 + n_2 - 2}}$$

Multilevel meta-analysis: Experimental group studies

Certain interventions are deemed effective when related studies show consistent results. Meta-analytic techniques are appropriate for summarizing independent studies using computed effect size. When the computed effect size varies from study to study, however, the researchers face a challenge in formulating and testing possible explanations for variations across the studies. Multilevel HLM is an appropriate method for this purpose (Yeo & Hong, 2011). Therefore, this study was conducted using HLM with a level-two model.

Our analysis using the level-two model followed the steps suggested by Raudenbush and Bryk (2002). The equation of the level-one model is presented in [1].

$$d_i = \delta_j + e_j \qquad [1]$$

For studies $j = 1,...,j$, e_j is the sampling error associated with d_j as an estimate of δ_j, and we assume $e_j \sim \mathrm{N}(0,\ V_j)$.

In the level-two model, the computed effect size will be established to determine the variables that influence the effect size. Equation [2] allowed the researchers to view the true-effect sizes, δ_j, as varying around a grand mean, γ_0, plus a level-two error, u_j.

$$\delta_j = \gamma_{q0} + u_j \qquad [2]$$

The true parameter, δ_{qj}, varies as a function of the predictor variables measured at level two, plus error:

$$\delta_{qj} = \gamma_{q0} + \sum_{s=1}^{sq} \gamma_{qs}\ W_{sj} + u_{qj} \qquad [3]$$

where W_{sj} is a predictor variable, γ_{qs} is the corresponding regression coefficient, and u_{qj} is the unique effect for each unit *j*.

Reliability of coding

To assure the reliability of the computed effect sizes, three coders participated in the coding procedures. Two master's students in special education each coded twelve studies, and the researcher coded the rest. To ensure that the coding procedures were accurately administered, the two coders were trained by the researcher, and the accumulated coding results were cross-checked and evaluated for inter-rater agreement. The inter-rater agreement was calculated as the number of agreements divided by the total number of agreements and disagreements. The average inter-rater reliability was 92.5%, but all coders discussed and reconciled any disagreements.

Results

To control for effect sizes that could have an excessive influence on other variables (Petscher, 2010), outliers were detected using NCSS 9 box plots. Effect sizes below -2.5 or above 5.1 were identified as outliers and were eliminated. Seven of the 125 effect sizes from the 23 selected studies were eliminated, which left 118 effect sizes for this study. Table 1 shows the overall characteristics of each study in detail.

Table 1 Overall Information for the Included Studies

Authors (year)	Published (y/n)	Design	N	Grade Level	Type of MT	Dependent Variables	Disability	Used Music	Preferred Music (y/n)	Duration (session/min)	No. of ESs
Choi (2000)	y	Con/Exp	40	Mixed	Passive	CB	Developmental	Live	n	5/-	2
Choi (2006)	n	Con/Exp	20	High	Active	E	Multiple	Live	n	10/80	2
Choi, Han, & Cheong (2009)	y	Con/Exp	24	Elementary	Active	CB	Developmental	Both	y	22/50	4
Chun (2004)	n	Ps as Con	4	Elementary	Active	CB, S	Developmental	Live	n	12/40	8
Jung (2003)	n	Ps as Con	24	Elementary	Active	E	Developmental	Live	n	30/50	4
Jung (2008)	y	Ps as Con	7	Elementary	Active	E	Developmental	Both	n	15/40	6
Kang (2009)	n	Con/Exp	24	Middle	Active	E	Developmental	Both	n	15/45	5
Kim (2000)	n	Ps as Con	5	Elementary	Active	CB	Developmental	Live	n	22/-	1
Kim (2009)	n	Ps as Con	19	Elementary	Active	E, S	Developmental	Both	n	18/30	5
Kim (2011)	n	Con/Exp	14	Elementary	Active	CB	Developmental	Live	n	14/40	3
Kim (2012)	n	Ps as Con	7	Elementary	Active	CB, S	Developmental	Both	n	12/50	11
Kim & Kim (2004)	y	Ps as Con	4	Elementary	Active	S, E	Developmental	Both	n	24/20	6
Lee (2002)	n	Con/Exp	31	Mixed	Active	CB	Developmental	Live	n	4/20	1
Lee (2011)	n	Con/Exp	16	Middle	Active	E	Developmental	Both	n	12/45	5
Lee (2014)	n	Ps as Con	6	Elementary	Active	E, S	Developmental	Both	y	12/50	2
Nam, Cheong, & Choi (2013)	y	Ps as Con	5	Mixed	Active	E	Physical	Live	n	12/50	6
Park (2013)	n	Con/Exp	31	Middle	Eclectic	CB	Multiple	Both	n	8/45	1
Shin & Yoon (2011)	y	Con/Exp	5	Elementary	Active	CB, S	Behavioral	Both	y	13/35	9
Sung (1999)	y	Ps as Con	7	Elementary	Active	CB	Developmental	Both	n	18/30	4
Sung, Cheong, & Choi (2012)	y	Ps as Con	7	Elementary	Active	S, E	Physical	Both	n	15/50	3
You, Jeon, & Kim (2009)	y	Con/Exp	10	Elementary	Active	CB, S	Behavioral	Both	y	12/50	7
You & Kim (2008)	y	Ps as Con	5	Elementary	Active	CB	Behavioral	Both	n	12/50	3
Yu (2005)	n	Ps as Con	8	High	Active	E, S	Developmental	Both	y	30/40	20
Total 23 studies											**118**

* MT = Music therapy / Ps as Con = Participant as own control / Con = Control group / Exp = Experimental group / CB = Cognitive-behavioral / E = Emotional / S = Social / "-" = not specified

Homogeneity analysis: Unconditional model

To determine the feasibility of using two-level meta-analysis, the homogeneity of the effect sizes must be tested first. Homogeneity analysis should be performed with unconditional model analysis, the results of which are displayed in Table 2. The heterogeneity of the effect sizes was shown in the result (r = 0.169, x^2= 205.424, $p < 0.001$). The mean effect size, which was represented by a coefficient of fixed effect, was also generated from this analysis. The coefficient was 1.072 (t = 17.157, $p < 0.001$), which we interpreted as the mean effect size of music therapy interventions for students with disabilities. According to the generally implemented effect size interpretation guidelines suggested by Cohen (1977), the mean effect size of 1.072 is considered large ($d \leq 0.20$ is small; $d = 0.50$ is medium; $d \geq 0.80$ is large). Given these results, a conditional model analysis was warranted to investigate the moderating effects.

Table 2 Results of the Unconditional Model Analysis

Fixed Effect	Coefficient	Standard Error	t	95% Confidence Interval	
				Upper	Lower
γ_0	1.072	0.062	17.157***	1.194	0.950
Random Effect	Variance Component (r)		Standard Deviation	x^2	
υ_j	0.169		0.411	205.424***	

***$p < 0.001$; γ_0 = Overall effect size, υ_j = Two-level random error.

Moderator analysis: Conditional model

A conditional model using HLM was used to detect the variables that influenced the computed effect sizes in this meta-analysis. Only variables without multicollinearity problems were selected as predictors for the moderator analysis. The selected predictors were categorized into four groups: student-related, intervention-related, implementation-related, and dependent variables. These predictors were reference coded with sets of created dummy variables.

Student-related variables

The effectiveness of music therapy interventions for students with disabilities was moderated by student-related variables. The results are displayed in Table 3. This study categorized participants into elementary, middle/high, and mixed-grades groups. The results indicated that the average of the grand mean effect size for the elementary student group was 1.041 (t = 13.532, $p < 0.001$). An elementary student group was fixed as a reference group for comparison with mixed and middle/high school student groups. The mean effect size of the mixed-grades group was significantly lower (-0.448, t = -2.143, $p < 0.05$) than the effect size of the elementary student group.

Regarding disability types, one of the higher-incidence disabilities in special education settings, developmental disorders, was fixed as a reference group and compared with behavioral, multiple, and physical disorders (Annual Report of Korean Special Education, 2017). The mean effect size of development disorders was very large (1.144, t = 15.656, $p < 0.001$), but

none of the predictors was statistically significant. The result suggests that student disability type did not lead to significant differences in mean effect sizes.

Table 3 Results of the Moderator Analysis for Student Grade Level and Disability Type

Fixed Effect	Coefficient	Standard Error	*t*	95% Confidence Interval	
				Upper	Lower
γ_0(elementary)	1.041	0.077	13.532***	1.192	0.890
γ_1(mixed-grade)	-0.448	0.210	-2.143*	-0.036	-0.860
γ_2(middle/high)	0.203	0.130	1.565	0.458	-0.052
Random Effect	Variance Component(*r*)		Standard Deviation	x^2	
υ_j	0.148		0.385	192.596***	
Fixed Effect	Coefficient	Standard Error	*t*	95% Confidence Interval	
				Upper	Lower
γ_0(developmental)	1.144	0.073	15.656***	1.287	1.001
γ_1(behavioral)	-0.254	0.183	-1.386	0.105	-0.613
γ_2(multiple)	-0.262	0.432	-0.606	0.585	-1.109
γ_3(physical)	-0.314	0.231	-1.355	0.139	-0.767
Random Effect	Variance Component(*r*)		Standard Deviation	x^2	
υ_j	0.181		0.425	203.567***	

***p < 0.001; **p < 0.01; *p < 0.05; The overall effect size when $\gamma_0 = \gamma_1$, γ_2 is 0 or when $\gamma_0 = \gamma_1$, γ_2, γ_3 is 0; υ_j = the residual effect size.

Intervention-related variables

Table 4 shows the results of the moderator analysis for intervention-related variables. The significant coefficient, the average of the grand mean effect size, for active music therapy was 1.089 (t = 17.946, p < 0.001). Only passive types of music therapy were statistically significant when active music therapy was fixed as a reference group (-1.036, t = -3.022, p < 0.001). Passive music therapy showed negative correlations with active music therapy, which can be interpreted as having smaller effect sizes, whereas the difference between eclectic and active music therapy was not statistically significant (0.174, t = 0.323).

Table 4 Results of the Moderator Analysis for Music Therapy Approaches

Fixed Effect	Coefficient	Standard Error	*t*	95% Confidence Interval	
				Upper	Lower
γ_0(active)	1.089	0.061	17.946***	1.209	0.969
γ_1(eclectic)	0.174	0.540	0.323	1.232	-0.884
γ_2(passive)	-1.036	0.343	-3.022***	-0.364	-1.708
Random Effect	Variance Component (*r*)		Standard Deviation	x^2	
υ_j	0.128		0.357	185.068***	

***p < 0.001; **p < 0.01; *p < 0.05; Overall effect sizes when $\gamma_0 = \gamma_1$, γ_2 are 0 or when $\gamma_0 = \gamma_1$ is 0; υ_j = the residual effect size.

Implementation-related variables

In Table 5, the estimated grand mean effect size for small-group interventions is shown as 1.067 (t = 12.016, p < 0.001). Both individual and large-group interventions were selected as predictors to identify the moderating effects on effect size differences. The small-group interventions were fixed as a reference group and compared with individual and large-group interventions. The coefficient of the small-group interventions was 1.067, indicating very large effects, but the changes in effect based on intervention group size were not significantly different (0.871, t = 1.704; -0.019, t = -0.152).

Table 5 Results of the Moderator Analysis for Implementation-Related Variables

Fixed Effect	Coefficient	Standard Error	t	95% Confidence Interval	
				Upper	Lower
γ_0(small-group)	1.067	0.089	12.016***	1.241	0.893
γ_1(individual)	0.871	0.511	1.704	1.873	-0.131
γ_2(large-group)	-0.019	0.125	-0.152	0.226	-0.264
Random Effect	Variance Component (r)		Standard Deviation	x^2	
υ_j	0.163		0.403	199.536***	

***p < 0.001; The overall effect sizes when $\gamma_0 = \gamma_1, \gamma_2$ are 0; υ_j= the residual effect size.

Dependent variables

Finally, the analysis was moderated by dependent variables, which are displayed in Table 6. The dependent variables of the included studies (emotional, social, and cognitive-behavioral factors) were selected as predictors. The mean effect size for the emotional variable was estimated as 1.086 (t = 13.749, p < 0.001). The emotional factor was fixed as a reference group that was then compared with the cognitive-behavioral and social variables, but no significant difference was found (0.014, t = 0.141; -0.214, t = -0.866).

Table 6 Results of the Moderator Analysis for Dependent Variables

Fixed Effect	Coefficient	Standard Error	t	95% Confidence Interval	
				Upper	Lower
γ_0(emotional)	1.086	0.079	13.749***	1.241	0.931
γ_1(cognitive-behavioral)	0.014	0.141	0.141	0.290	-0.262
γ_2(social)	-0.214	0.247	-0.866	0.270	-0.698
Random Effect	Variance Component (r)		Standard Deviation	x^2	
υ_j	0.176		0.419	204.947***	

***p < 0.001; *p < 0.05; Overall effect sizes when $\gamma_0 = \gamma_1, \gamma_2$ are 0; υ_j = the residual effect size.

Discussion

This study was designed 1) to determine the estimated grand mean effect size of music therapy for students with disabilities and 2) to identify student-related, intervention-related, implementation-related, and dependent variables that influence the effectiveness of music therapy for students with disabilities. A two-level meta-analysis was conducted to achieve these goals and to provide sufficient findings to establish evidence-based intervention for individuals with special needs in educational settings. Twenty-three music therapy intervention experimental group studies with 118 generated effect sizes were analyzed using two-level meta-analysis with HLM. The results of this study demonstrate large effects of music therapy interventions on students with disabilities (overall ES = 1.072). These promising results were consistently observed across all variables, with no significance except grade level and music therapy approach type. The detailed research findings are discussed in this section.

Music therapy interventions for students with disabilities were not equally effective across grade levels. When the elementary grade level was established as a reference group, significantly lower effects were found in the mixed-grades group consisting of students from multiple grade levels. This result supports the findings of the earlier meta-analysis by Kim (2002), who reported greater effects in music therapy studies that divided students into age-based groups. This finding confirms the general assumption of the benefits of forming homogenous intervention groups, particularly in terms of grade. Students with disabilities present unique needs arising from their disabilities, but these differences can be magnified by the needs of their particular developmental stage. The heterogeneity of the intervention group can make it difficult to create effective learning environments and evaluations (Esposito, 1973), which can ultimately reduce the effects of intervention. Group dynamics, an important factor for effective intervention, can be clearly affected by the group members (Silverman, 2003). Therefore, researchers and practitioners who design music therapy interventions should try to form homogenous intervention groups that consider the characteristics of each group member.

The students' disability types were also investigated as a moderating variable. The coefficient obtained from a two-level analysis showed that music therapy had greater effects for students with developmental disorders than for those with any of the other three types of disabilities (behavioral, physical, and multiple disorders), but the differences were not significant. Developmental disorders are high-incidence disabilities in educational settings in South Korea (Annual Report of Korean Special Education, 2017), and students with these disorders often receive occupational therapy, physical therapy, and speech and language therapy as related services (Jo, 2010), suggesting that students with this disability are assigned to therapies that explicitly meet their individual needs rather than therapies that mirror their interests. Unfortunately, however, only a few studies were found that reported significant therapeutic effects of the mentioned therapies for students with developmental disabilities. This result reflects the fact that these therapies (e.g., speech and language therapy for students with speech and language disorders) are not flexible enough to establish individualized therapeutic aims for students. In contrast, the results of the present study show that music therapy is a promising related service that can meet a variety of needs among students with developmental disabilities.

Active music therapy was found to have significantly greater effects than passive music therapy. The significant difference in favor of active music therapy was assumed to indicate

that it was appropriate for the students' developmental characteristics. School-aged children are usually described as moody, restless, and unpredictable, which naturally leads them to be interested in real-life experiences (Caskey & Anfara, 2007). Anecdotal evidence also suggests that active music therapy has particularly large effects on students with developmental or behavioral disorders and that music helps these students focus and sustain their attention (Wigram & De Backer, 1999). Moreover, active music therapy seemed to be used as a tool to satisfy diverse students' needs and allow them to express their negative energy in a safe environment (Davis, Gfeller, & Thaut, 1999). In fact, several studies suggest that eclectic music therapy is the most effective approach (Gold et al., 2004; Silverman, 2003). Taken together, these complex results indicate the need for further research to clarify these differences.

One of the important factors to consider in special education is individualization, and the advantage of music therapy is its flexibility due to its familiarity, viability, and ability to induce intrinsic motivation of participants (Adamek & Darrow, 2010). The group size difference was not significant, but it was found that the smaller the group size, the larger the effect size. This result supports Kim's (2002) study, which reported the greatest effects of music therapy interventions in small groups of fewer than nine participants. This led to the conclusion that the degree of individualization was the key to success with students with disabilities for two reasons. First, the smaller group setting allows music therapists to choose a variety of therapy techniques that best fit each individual's interests and needs (Gold et al., 2004). Second, the smaller group intervention can increase the level of musical interaction among participants (Pavlicevic, Trevarthen, & Duncan, 1994; Silverman, 2003). This result suggests that the smaller group interventions can be more beneficial, offering more flexibility to meet students' needs and providing more active musical interactions.

There is a preconception about music therapy's effects: that music therapy is only effective for generating emotional and social benefits. However, the overall findings support the claim that music therapy is a promising intervention for resolving academic problems in students with disabilities, along with other therapeutic goals. There is overwhelming evidence corroborating the notion that music therapy is an effective approach for achieving educational objectives (Butzlaff, 2000; Črnčec, Wilson, & Prior, 2006; Standley, 1996). Therefore, the results of this study will enable the facilitation of an evidence-based practice that will stabilize overall therapeutic effects regardless of the institutions' or the therapists' characteristics. It will also provide practical implications for establishing objective grounds for improvement of the existing system for the provision of related services that will lift some of the burden from educators who are unaware of how to address the problems that students with disabilities display.

Implications for practice

There are several limitations to this study that should be addressed and should be considered when accepting these research findings. First, this study included unpublished dissertations and theses to avoid publication bias, but doing so resulted in the inclusion of more unpublished studies than published ones (unpublished = 13, published = 10). Additionally, the music therapy interventions in South Korea were mostly delivered to students with developmental disabilities, with the goal of providing emotional benefits. This concentrated research trend could limit music therapy in terms of its qualitative development. Thus, the results of this meta-analysis

should be interpreted with caution. It should also be noted that in the future, music therapy researchers and practitioners should implement music therapy interventions in a wider range of populations using diverse techniques.

Second, this meta-analysis attempted to synthesize music therapy intervention studies for students with disabilities to understand the trends and effects in the field. Consequently, all disabilities that are listed under SELPDO (2007) were included in the analysis. Overall, this study provides valuable information for music therapy researchers and practitioners; however, it is limited to reviewing the specific contents of interventions while considering disability type. Therefore, further research should demonstrate the unique contribution of certain intervention contents for specific disabilities and degrees of severity .

Finally, this study could not include measurement-related variables to evaluate its moderating effects. We attempted to code quality indicators for measurement-related variables, such as the fidelity of the intervention, external validity, and social validity, as suggested by Gersten et al. (2005). Unfortunately, however, the majority of the selected studies did not provide sufficient information to be used as a moderating variable for meta-analysis. In other words, the studies selected for this meta-analysis did not fully meet the necessary quality indicators to be considered high-quality research. Music therapy researchers in South Korea should pay more attention to obtaining the necessary information to ensure the quality of their research. Doing so will allow their efforts to make a greater contribution to establishing evidence-based music therapy interventions for students with disabilities.

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