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The Effectiveness of Improvisational Music Therapy in Improving Communication and Social Interaction Skills in Children and Adolescents with Autism Spectrum Disorder: Systematic Review

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ABSTRACT
The use of music as a therapeutic intervention has the potential to help children and adolescents with Autism Spectrum Disorder (ASD), especially in improving their communication and social interaction skills. Currently, the most common form of music therapy given to children and adolescents with ASD is improvisational music therapy. The therapeutic relationship formed by the improvisation of the therapist and the participant has the potential to increase attention, interaction, communication, and to build social relationships. This systematic review was conducted to examine various research results regarding the effectiveness of improvisational music therapy in improving communication and social interaction skills in children and adolescents with ASD. After conducting a systematic search of studies from five databases, eight Randomized Controlled Trials (RCTs) were obtained with participants ranging from 3-16 years old. Among eight studies, one study shows significant results, five studies show mixed results (significant and insignificant), and two studies show insignificant results. The result indicates no firm conclusion can be drawn regarding the effectiveness of improvisational music therapy in improving communication and social interaction skills in children and adolescents with ASD. The quality and limitations of each study, as well as suggestions for further research are discussed in this systematic review.

Keywords: *Improvisational Music Therapy, Communication, Social Interaction, Autism Spectrum Disorder, Systematic Review.*

1. INTRODUCTION

Autism Spectrum Disorder (ASD) is a developmental disorder that may occur at childhood. The prevalence of ASD continues to increase every year, where in 2000, ASD prevalence was 6.7% and continued to increase to 18.5% in 2016 [1].

ASD is a neurodevelopmental disorder characterized by a lack of social communication skills, social interaction, and the exhibition of certain behavioral patterns [2]. Symptoms of ASD may appear from the age of 12-24 months where the child experiences delays in development. In addition, ASD may lead to difficulties in learning, being independent, and psychosocial functioning [2].

There are several behavioral and communication interventions that are generally administered to individuals with ASD, such as Applied Behavior Analysis (ABA), occupational therapy, and speech therapy, dietary approaches, and medications [3]. However, recently, the potential use of music as therapy for individuals with ASD has also been increasingly recognized with supporting studies [4-7].

One of the reasons why music has the potential to be used as a therapeutic tool for ASD individuals is the ability to process music well among ASD individuals despite having difficulties in communicating [5]. The results of magnetic resonance imaging (MRI) in the brains of ASD individuals showed that activity in the part of the brain that processes language and music (left inferior frontal gyrus) was lower than the control group when given a speech stimulus [5]. However, it was found

that activity in this part of the brain is higher than the control group when given two simultaneous stimuli of words and songs. In addition, it was also found that ASD individuals were more effective at processing speech and songs together, compared to verbal speech alone without songs [5].

In addition, there was a study on individuals with ASD and normal individuals who were given a musical puzzle, in which participants needed to sort pieces of a song that had been arranged randomly [7]. It was found that ASD individuals had the same ability as normal individuals in processing music.

A review also showed that although ASD individuals have difficulty understanding emotions in a social context, ASD individuals can understand emotions from music [6]. In addition, ASD individuals also give a greater attentional response to music than other sound stimuli (such as verbal speech or sounds from the surrounding environment) [6]. Having good music processing skills, emotional recognition (through music), and an interest in music can support the use of music as a therapy tool for ASD individuals [6].

Music therapy is defined as a clinical and evidence-based musical intervention that is administered to achieve a therapeutic goal [8]. There are 2 types of Music therapy, namely active/expressive music therapy and passive/receptive music therapy [9]. Active music therapy involves active participation in making music, for example by singing, playing an instrument, or improvising music. Passive music therapy is done by listening to music given by the therapist live or recorded.

To treat individuals with ASD, the most commonly encountered music therapy is active music therapy with improvisation. Improvisation method involves the client to make music, including making various sounds or melodies with various media such as sounds from the mouth and body, percussion, or other musical instruments [10]. The therapist also spontaneously shapes these sounds into something that has meaning, with a certain rhythm, melody, or harmony. Improvisation in music therapy also emphasizes the relationship between therapist and client, where music can also be used as a means to communicate nonverbally [11].

Generally, improvisational music therapy is given to individuals with ASD because this therapy is a type of child-led therapy, where the therapist follows the client [12]. In the context of music therapy, the therapist follows the music produced by the client in order to maintain the client's attention and interest, as well as build rapport, engagement, and communication. Thus, improvisational music therapy can help individuals with ASD, especially in improving their social interaction skills [12].

Currently, there are few studies that have examined the effectiveness of music therapy for children and adolescents with ASD. A meta-analysis was conducted on nine quantitative studies from 1983 to 2002 to look at the overall effect size of music therapy in improving the social, communication, and cognitive aspects of children and adolescents with autism [13]. The results of the study showed that music therapy was effective with a fairly large effect size ($d = 0.77$; CI: 0.46-1.08). However, these studies were not specific to any particular method of music therapy, and the design of the included studies varied [13].

Then, there was a meta-analysis study that looked at the effectiveness of music therapy for children with ASD [14]. From the article selection process, ten Randomized Controlled Trial (RCT) and Controlled Clinical Trial (CCT) studies from 1995 to 2012 were obtained for further analysis. The results showed that music therapy was more effective than placebo therapy or standard therapy for children with ASD, especially in improving aspects of communication and social interaction. However, the music therapy covered in this study is still not specific to a particular method [14].

In addition, there is a literature review that reviewed 18 studies with various research designs from 2002 to 2014 [15]. The results showed that music therapy is a promising therapy for individuals with ASD in improving communication and social interaction skills. Of the 18 studies, 11 studies yielded results that support the effectiveness of music therapy. However, this literature review still combines various music therapy methods [15].

Because previous studies have not examined the effectiveness of specific music therapy, a systematic review will be conducted to examine further the effectiveness of one type of music therapy that is frequently given to ASD individuals, the improvisational music therapy. This study was conducted to analyze the effectiveness of improvisational music therapy qualitatively in improving communication and social interaction skills in children and adolescents with ASD. This systematic review will also review the quality of the research and discuss the limitations of the various studies obtained.

2. METHOD

2.1. Selection Criteria

First, the population or participants in the study must be children or adolescents with Autism Spectrum Disorder (under 19 years of age). Participants also did not have other comorbidities such as intellectual disability. Studies that do research on a variety of disorders will be included if they show separate results for ASD.

Second, studies should examine the effectiveness of music therapy interventions using improvisational methods. The therapy can be given individually or in groups.

Third, the study should compare the experimental group with the control group, where the control group must be individuals with ASD as well. The control group can be given a placebo intervention, standard intervention, other interventions (such as play therapy), or no intervention.

Fourth, studies must show results on communication skills, and/or social interaction.

Fifth, the study must be a Randomized Controlled Trial (RCT) and written in English. The publication year of the study will be limited from 2000 to 2021.

In addition, the exclusion criteria that have been determined are: (a) studies comparing ASD participants with non-ASD participants; (b) the study does not provide detailed information on the results of the study; and (c) the study does not have accessible full-text.

2.2. Search Method Used to Identify Studies

The search for articles was conducted on five databases, namely: PsycINFO, PubMed, ScienceDirect, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and the Cochrane Library. The year of publication is limited from 2000 to 2021.

The keywords that will be used in the search are as follows: (a) Music Therapy AND Autism, (b) Music Therapy AND Autistic, and (c) Music Therapy AND Autis*. If there is a feature to filter the type of research, an RCT (Randomized Controlled Trial) filter will be used. The keywords "children", "adolescents", and "improvisational" were not used because there was a possibility that these keywords were not included in the title of the study, so the age of participants and types of improvisational music therapy would be analyzed based on their content.

2.3. Data Extraction

From the chosen articles, information that will be collected include: (a) year of publication of the study, (b) number of participants, (c) age range of participants, (d) number of male participants, (e) outcome variables, (f) the duration of the interventions, and (g) the measurements used.

2.4. Assessment of Risk of Bias

The risk of bias to internal validity is assessed using the Cochrane Risk of Bias Tool, in which 6 aspects are considered, namely: (a) selection bias, (b) performance bias, (c) detection bias, (d) attrition bias, (e) reporting bias, and (f) other bias [16].

3. RESULTS

The search on PsycINFO yielded 12 studies, PubMed 20 studies, ScienceDirect 782 studies, CINAHL 13 studies, and Cochrane Library 59 studies. A total of all studies collected were 886 studies. After selection, 8 studies were chosen and will be used in this systematic review study [17-24]. All stages of study selection can be seen in Figure 1.

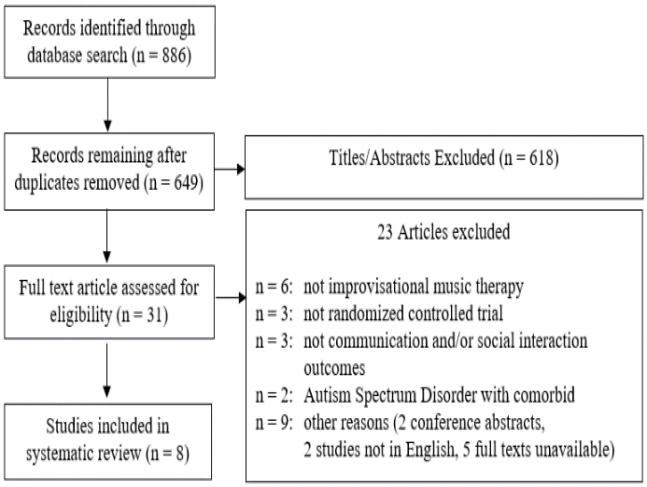

Figure 1 Flowchart of the selection process of the included studies

3.1. Participant Characteristic

All participants were ASD individuals under 17 years old [17-24]. Most of the participants were male. Participant information can be seen more clearly in Table 1.

Table 1. Participant Characteristic

Author and Year	Age	N	N Boys
Kim et al., 2008	3-5	10	10
Kim et al., 2009	3-5	10	10
Gattino et al., 2011	7-12	24	24
Thompson et al., 2013	3-6	21	18
Bieleninik et al., 2017	4-7	364	302
Porter et al., 2017	8-16	34	No Information
Sharda et al., 2018	6-12	51	33
Rabeyron et al., 2020	4-7	36	31

3.1. Measurements Used in the Studies

In all eight studies, there were ten different measuring tools to measure communication and social interaction skills [17-24]. Two of them are diagnostic tools (Childhood Autism Rating Scale [CARS] and Autism Diagnostic Observation Schedule [ADOS]). In addition, there are also two studies that conducted observation as a method to evaluate the skills after therapy. The measuring instruments used in each study can be seen in Table 2.

Table 2. Measurements used in the studies

Author and Year	Measurements
Kim et al., 2008	1. Pervasive Developmental Disorder Behavior (PDDBI) 2. Early Social Communication Scale (ESCS) 3. Observation
Kim et al., 2009	1. Observation
Gattino et al., 2011	1. Childhood Autism Rating Scale adapted for Brazil (CARS-BR)
Thompson et al., 2013	1. Vineland Social-Emotional Early Childhood Scales (VSEEC) 2. Social Responsiveness Scale Preschool Version for 3-Year-Olds (SRS-PS) 3. MacArthur-Bates Communicative Development Inventories, Words and Gestures (MBCDI-W&G)
Bieleninik et al., 2017	1. Autism Diagnostic Observation Schedule (ADOS) 2. Social Responsiveness Scale (SRS)
Porter et al., 2017	1. Social Skills Improvement System Rating Scales (SSIS)
Sharda et al., 2018	1. Children's Communication Checklist – 2 (CCC-2) 2. Social Responsiveness Scale – II (SRS-II) 3. Peabody Picture Vocabulary Test – 4 (PPVT-4)
Rabeyron et al., 2020	1. Childhood Autism Rating Scale (CARS)

3.2. Characteristics of Intervention

In all eight studies, it was found that the number of sessions of improvised music therapy ranged from 8 to 60 sessions, with a duration of about 30 to 45 minutes for each session [17-24]. The number of sessions and the duration of each session in each study can be seen in Table 3.

In five studies, interventions were administered individually [17-19, 22, 23]. In a study conducted by Bieleninik et al. [21], the intervention was given individually as well, but there were some participants who were accompanied by their parents. In addition, there is one study that provides intervention to participants and their parents [20], and there is one study that provides intervention in groups [24]. All interventions were administered by professional music therapists.

Table 3. Characteristics of intervention

Author and Year	Number of Sessions	Duration per Session
Kim et al., 2008	12	30 minutes
Kim et al., 2009	12	30 minutes
Gattino et al., 2011	16	30 minutes
Thompson et al., 2013	16	30-45 minutes
Bieleninik et al., 2017	High Intensity: 60	30 minutes
	Low Intensity: 20	30 minutes
Porter et al., 2017	12	30 minutes
Sharda et al., 2018	8-12	45 minutes
Rabeyron et al., 2020	25	30 minutes

3.3. The Effectiveness of Improvisational Music Therapy

In all eight studies, one study showed significant results on emotional synchronicity and initiation of engagement [18].

In addition, there were five studies that showed mixed results (significant and insignificant). The study conducted by Thompson et al. [20] showed insignificant results on social responsiveness and language and speaking skills, but showed significant results on social functioning. The study conducted by Kim et al. [17] showed insignificant results on the social approach, but there were significant results on joint attention, eye contact, and turn-taking. The study conducted by Bieleninik et al. [21] showed insignificant results on

social affect, but showed significant results on social responsiveness. The study conducted by Sharda et al. [23] showed insignificant results on social responsiveness and receptive vocabulary, but showed significant results on social communication. The study conducted by Gattino et al. [19] showed insignificant results on verbal communication and social communication, but showed significant results on non-verbal communication.

Then, there were two studies that showed insignificant results. The study conducted by Porter et al. [22] showed insignificant results on social skills. In addition, the study conducted by Rabeyron et al. [24] also showed insignificant results on symptom severity (including the relationship to people, imitation, emotional response, verbal communication, and non-verbal communication subscales).

In all eight studies, it was shown that there was an increase in communication and social interaction scores after the improvisational music therapy intervention, but some of them were not statistically significant [17-24].

3.4. Risk of Bias in Included Studies

The eight studies have been reviewed for quality by assessing the risk of bias. Most studies have a low risk of bias in various aspects, with details as follows: six out of eight fulfill the first aspect (random sequence generation), five out of eight fulfill the second aspect (allocation concealment), seven out of eight fulfill the fifth aspect (incomplete outcome data), and eight out of eight fulfill the sixth aspect (selective reporting) [17-24]. The results of the risk of bias assessment can be seen in Table 4.

Table 4. Risk of bias assessment results

Author and Year	1	2	3	4	5	6	7
Kim et al., 2008	?	?	?	?	+	+	?
Kim et al., 2009	?	?	?	-	+	+	?
Gattino et al., 2011	+	+	?	+	+	+	?
Thompson et al., 2013	+	+	?	-	+	+	?
Bieleninik et al., 2017	+	+	?	?	+	+	?
Porter et al., 2017	+	+	?	?	?	+	?
Sharda et al., 2018	+	+	?	?	+	+	?
Rabeyron et al., 2020	+	?	?	+	+	+	?

Note. 1: Random sequence generation (selection bias), 2: Allocation concealment (selection bias), 3: Blinding of participants and personnel (performance bias), 4: Blinding of outcome assessment (detection bias), 5: Incomplete outcome data (attrition bias), 6: Selective reporting (reporting bias), 7: Other bias. (+): low risk of bias, (?): unclear risk of bias, (-): high risk of bias

The eight studies also have limitations, especially in the third aspect (blinding of participants and personnel), fourth (blinding of outcome assessment), and seventh (other bias) [17-24]. Regarding the third aspect (blinding of participants and personnel), the possibility of performance bias in research on this topic cannot be avoided. This can happen because blinding on the therapist and participants who receive therapy was not possible. Thus, all eight studies were rated as having unclear risk of bias [17–24].

Then, related to the fourth aspect (blinding of outcome assessment), there are many possibilities of detection bias in providing an assessment [17, 18, 20, 22-24]. The possibility of detection bias is due to the large number of parent-rated measuring instruments used in the eight studies. Most of the measuring tools used are parent-rated, except for diagnostic tools such as the Autism Diagnostic Observation Schedule (ADOS) and the Childhood Autism Ratting Scale (CARS) [17-24]. When using parent-rated measuring instruments, detection bias can arise because parents know the intervention given to their children.

Lastly, related to the seventh aspect (other bias), all studies were rated as having unclear risk of bias as there are limitation related to sample size, measurements used, and the duration of intervention [17-24].

4. DISCUSSION

This systematic review study was conducted to describe the effectiveness of improvisational music therapy in improving communication and social interaction skills in children and adolescents with Autism Spectrum Disorder (ASD). In addition, this study also reviews the quality of each study, as well as discusses the limitations that exist in researching the topic.

The number of studies with a Randomized Controlled Trial (RCT) design obtained on this topic is relatively small, eight articles over a period of 21 years (2000-2021) [17-24]. In examining aspects of communication and social interaction, there is one study that showed significant results [18], five studies that showed mixed results (significant and insignificant) [17, 19, 20, 21, 23], and two studies that showed no significant results [22, 24]. Therefore, the effectiveness of improvised music therapy in improving communication and social interaction skills in children and adolescents with ASD cannot be clearly concluded.

In all eight studies, there are some limitations. In seven studies [17-20, 22-24], the number of participants involved in the study was relatively small, ranging from 10 to 51 participants. Only one study involved a large sample size (364 participants) [21].

In the eight studies, ten different measuring instruments were found that were used to measure communication and social interaction skills. Two of them are measuring tools that help diagnosis, which are the

Autism Diagnostic Observation Schedule (ADOS) and the Childhood Autism Rating Scale (CARS) [19, 21, 24]. The use of diagnostic measurements may be inaccurate because they are considered less sensitive when used to assess development in ASD individuals in a short time [19, 25].

Then, in the eight studies, the duration of the improvisational music therapy intervention ranged from 3 months to 8 months [17-24]. Although eight months is a fairly long time, it is possible that it is not sufficient to see significant progress due to the nature of music therapy that is given continuously for years, not months [21].

Research on improvisational music therapy is also heterogeneous because it does not have a protocol or standardization in the provision of these interventions [24]. The quality of the therapeutic relationship between participants and therapists also greatly influences the development of participants, especially in the development of communication and interaction skills [26]. Therefore, the results of therapy are highly dependent on the skills of the music therapist.

Given the limitations that have been discussed, it is necessary to study the existence of other factors that could influence the results of improvisational music therapy further, such as the interests of ASD individuals in music. Currently, there are no studies in this subject.

Then, based on previous literature reviews and meta-analyses [13-15], it was found that music therapy (not specified to any methods) is an effective intervention to improve communication and social interaction skills in ASD individuals. Due to the differences in the results obtained in this systematic review study, it is necessary to study whether there are other types of music therapy that may be more effective for ASD individuals.

Finally, this systematic review study also has limitations, including the possibility that there are other studies that were not included because they are not included in the search process, for example: studies published in languages other than English, studies that are not published or are still in the process of publication, studies that were not found due to lack of keywords used, or other reasons. Therefore, these things can affect the results of this systematic review study.

5. CONCLUSION

Based on the results of a systematic review that has been conducted, eight studies from 2000 to 2021 showed various results, in which there was one study that showed significant results, five studies that showed mixed results (significant and insignificant), and two studies that showed insignificant results. In all studies included in this systematic review, it was found that children and adolescents with ASD experienced an increase in their communication and social interaction skills after receiving improvisational music therapy, but some of them were not statistically significant.

Therefore, no firm conclusions can be drawn regarding the effectiveness of improvised music therapy in improving communication and social interaction skills in children and adolescents with Autism Spectrum Disorder (ASD). For better results, more research needs to be done taking into account the limitations of previous studies.

AUTHORS' CONTRIBUTIONS

FO performed data analysis and wrote the manuscript. MPS and R supervised and revised the manuscript.

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