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오르프 접근법을 활용한 다운증후군 아동의 음악적 기능 향상 연구

Developing the Musical Skills of Children with Down Syndrome through the Orff Approach

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Abstract This study investigated the effectiveness of a rehabilitation program based on the Orff approach in enhancing the musical skills of children with Down syndrome, with a particular focus on their ability to play Orff instruments. A single-group pre-test–post-test experimental design was employed to evaluate the program's impact. The participants were eleven children with Down syndrome residing at the Al-Folk Charitable Foundation in Akwa Al-Hissa, Kafr El-Zayat, Tanta, Gharbia, during the 2022–2023 academic year. They took part in a structured rehabilitation program grounded in Orff's pedagogy, which emphasizes experiential learning through rhythm, movement, singing, and instrument playing. The program was conducted once a week for 60 minutes over a 20-week period. Data were collected using an observation checklist designed to assess Orff instrument performance skills, supported by a teacher's guide for program implementation. The findings revealed statistically significant improvements in both overall performance and sub-skills, with post-test scores significantly higher than pre-test scores. Furthermore, the program demonstrated substantial effectiveness in improving musical performance, underscoring its educational value for children with Down syndrome. These outcomes highlight the potential of Orff-based rehabilitation programs and recommend their broader application, as well as future studies to examine long-term benefits and adaptability across diverse educational settings.

Key words: rehabilitation program, Orff approach, Orff instruments, musical skills, children with Down syndrome

초록 본 연구는 다운증후군 아동의 음악적 기능 향상을 위해 오르프 접근법을 기반으로 한 재활 프로그램을 고안하고, 그 효과를 검증하는 것을 목적으로 한다. 이를 위해 가르비아 주 탄타 카프르 엘자얏 아콰 알히사에 위치한 알폴크 자선재단에 거주하는 다운증후군 아동 11명을 대상으로 단일집단 사전·사후 검사 설계를 적용하였다. 연구 참여 아동들은 20주간 주 1회 60분 동안 리듬, 움직임, 노래, 악기 연주를 통한 체험적 학습을 강조하는 오르프 접근법 기반의 체계적 재활 프로그램에 참여하였다. 자료는 오르프 악기 연주 능력을 측정하기 위해 고안된 관찰 체크리스트와 교사용 지도안을 통해 수집되었다. 연구 결과, 전체 연주 능력과 하위 영역에서 사전검사에 비해 사후검사 점수가 통계적으로 유의미하게 향상된 것으로 나타났다. 또한 프로그램은 음악 수행 능력 향상에 있어 실질적으로 높은 효과를 보여주었다. 이러한 결과는 오르프 접근법 기반 재활 프로그램이 다운증후군 아동의 음악 교육에 기여할 수 있음을 시사하며, 다양한 교육 환경에서의 확대 적용과 장기적 효과를 검증하기 위한 후속 연구의 필요성을 제안한다.

주제어: 재활 프로그램, 오르프 접근법, 오르프 악기, 음악적 기술, 다운증후군 아동

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Ⅰ. Introduction

Human societies have increasingly focused on educating children with special needs, and societal perceptions of them have shifted. Providing care and opportunities for these children has become one of the most important indicators of a society's progress and civilization. There has also been a growing emphasis on ensuring equal educational opportunities for all children, leading to the design of specialized educational and rehabilitation programs tailored to their needs. These programs aim to maximize their potential, elevate their educational levels, and improve their social adaptation and integration.

Musical activities play a significant role in enhancing the self-confidence of children with Down syndrome and fostering their sense of belonging, which is essential for their personal and social development (Al-Athmali, 2020). Down syndrome is one of the most common genetic disorders that affect physical and mental development, necessitating the development of effective rehabilitation programs to improve their quality of life. In this context, the Orff approach emerges as a valuable method for enhancing the musical and social skills of children with Down syndrome through playing Orff instruments. Music has been shown to have a profound positive impact on the cognitive, social, and motor skills of children with special needs, including those with Down syndrome (Bamakhrama, et al, 2020; Hamdi & Abdullah, 2022).

The Orff approach is rooted in active learning and social interaction, integrating music with movement to promote holistic learning. Research has demonstrated that musical programs involving group performance enhance children's communication and social interaction skills, thereby improving their fine motor abilities (Raba Center, 2023).

Intellectual disabilities are among the most impactful disabilities in society, as children with such disabilities often exhibit below-average intelligence levels, leading to noticeable deficits in cognitive functions such as attention, memory, and perception, as well as impaired social adaptation. Down syndrome is one of the most common examples of intellectual disabilities, resulting from an extra chromosome, which accounts for one-third of all moderate to severe intellectual disabilities. This condition leads to various neurological dysfunctions that affect the communication, educational, and motor skills of children with Down syndrome (Al-Sharbini, 2023).

Music lessons in the Orff approach begin with imitation, followed by individual exploration. Small groups are often formed, requiring students to collaborate with their peers, fostering teamwork. These lessons can be implemented through singing, speaking, playing musical instruments, folk dancing, and/or creative movement. Orff-based music lessons are typically

diverse and open-ended, often starting with folk songs, children's songs, folk dances, or even visual art pieces (Brandon, 2013). In Orff's classrooms, children begin with what they do instinctively: playing, imitating, experimenting, and expressing themselves personally. The Orff teaching model is considered an optimal learning framework for 21st-century classrooms (American Orff-Schulwerk Association, 2023).

Orff instruments include the triangle, cymbals, tambourine, maracas, xylophone, metallophone, and glockenspiel. Using these instruments, children with Down syndrome can enjoy their time while learning music. They can strike the instruments with sticks or shake them to produce sounds. During the learning process, children understand their primary roles, actively participate, and learn effectively through full engagement in the activity (Sarıkavak, 2022). The variations in sound characteristics and playing techniques make these instruments particularly engaging. The playing techniques allow children of all ages to play the instruments comfortably and confidently. These features enable children with special needs to express themselves freely through musical experiences and movements. Children can improve their musical skills by singing and using Orff instruments (Gökçe, 2007).

Several factors and indicators have contributed to the research problem, which can be summarized as follows. Based on the researchers' field experience during visits to the Al-Falak Charity Foundation for the care of children with Down syndrome in Akwa Al-Hissa Village, affiliated with Kafr El-Zayat Center in Gharbia Governorate, a number of challenges were observed. Despite the commendable efforts of the foundation, children with Down syndrome were found to have severe weaknesses in playing Orff instruments. In addition, they often relied on trial and error, attempting to play musical instruments independently, which highlights the need for new educational approaches and teaching methods.

The results of numerous Arab and international educational studies, as well as available theoretical frameworks, confirm that the prevalence of Down syndrome is approximately 1.5 per 1,000 children. This rate increases to 28 per 1,000 children for mothers aged 44 and above (Al-Zreiqat, 2012). Annually, around 3,000 to 5,000 children are born with this genetic disorder (Sultan, 2023). These statistics underscore that children with Down syndrome constitute a significant and non-negligible portion of society (Al-Kubaisi, 2020).

One of the primary challenges faced by children with Down syndrome is sensory developmental disorders, which lead to deficits in sensory-motor skills. Approximately 60% of children with Down syndrome suffer from hearing or visual impairments, which in turn hinder their ability to acquire skills in playing Orff instruments. This is often accompanied by slow learning rates

(Ali, 2018; Ali & Hussein, 2019; Al-Athmali, 2020; Al-Ibrahim, 2017; Al-Sayed, 2019; Al-Shamrani, 2015; Farhat, 2018; Shaheen, 2020; Siraj, 2017).

Additionally, the results of numerous studies have highlighted the role of music education in leveraging the remaining abilities of children with Down syndrome. Music education helps mitigate the risks and challenges arising from sensory developmental disorders, improves children's overall skills, enhances sensory development, addresses weaknesses and deficits, and stimulates auditory, visual, tactile, and motor systems by creating an environment rich in musical stimuli and activities (Adamek & Darrow, 2010).

Several conferences have recommended allocating resources to establish a permanent curriculum for training and employment related to programs and services provided to children with Down syndrome. They emphasized the importance of encouraging research and providing adequate financial support to ensure their right to free education. Additionally, they called for the appointment of training counselors in all schools and the development of a clear social model for delivering services related to health, education, and training. Several conferences have recommended allocating resources to establish a permanent curriculum for training and employment related to programs and services provided to children with Down syndrome. They emphasized the importance of encouraging research and providing adequate financial support to ensure their right to free education. Additionally, they called for the appointment of training counselors in all schools and the development of a clear social model for delivering services related to health, education, and training.

The research problem centers on the evident need to design a program aimed at improving the skills of playing Orff instruments among children with Down syndrome. This need arises from the researchers' field observations, findings from previous studies, and recommendations from relevant conferences, all of which point to a noticeable decline in these musical skills within this population. While numerous studies have confirmed the role of music education in fostering skill development and mitigating many of the challenges associated with Down syndrome, no prior research, to the researchers' knowledge, has specifically examined the effectiveness of the Orff approach in this context. Accordingly, this research seeks to answer two central questions: first, what is the rehabilitation program based on the Orff approach for developing Orff instrument playing skills among children with Down syndrome; and second, how effective is this training program in equipping these children with the necessary skills to play Orff instruments. The overarching aim of the research is to evaluate the effectiveness of the proposed rehabilitation program in enabling children with Down syndrome to acquire and apply the musical skills required for playing Orff instruments.

II. Literature Review

Given that the current research aims to investigate the effectiveness of a program based on the Orff approach to develop the skills of playing Orff instruments among children with Down syndrome, the theoretical framework addresses the following variables: categories of disabilities, Down Syndrome, The Orff approach (Orff Schulwerk), Orff instruments.

1. Categories of disabilities

Disability in educational contexts encompasses a wide spectrum of conditions that affect students' cognitive, behavioral, communicative, and physical functioning. These conditions are typically grouped into categories, each requiring unique educational approaches and support. Cognitive disabilities, also referred to as intellectual disabilities, are generally classified based on intellectual functioning, with conditions like Down syndrome falling under this category, often marked by developmental delays and distinct physical characteristics. Learning disabilities, which affect areas such as reading, writing, and mathematics, present challenges in both academic progress and communication (Langer, 2013). Emotional and behavioral disorders, which involve internalizing behaviors such as anxiety or depression, and externalizing behaviors like aggression, often interfere with academic and social development, requiring specialized interventions (Patton, 2018).

Communication disorders, including speech and language difficulties, further complicate the learning experience for students, impeding their ability to effectively engage both socially and academically. Physical disabilities and other health impairments (OHI), such as cerebral palsy or ADHD, also impact participation in school activities, with students needing support to manage energy levels and physical functioning (Nseibo, 2024). Similarly, students with hearing impairments often face challenges in language-related subjects, as they rely on visual cues and alternative methods for communication (Langer, 2013). Visual impairments, ranging from low vision to complete blindness, may lead to social withdrawal and hinder academic success, although aids like Braille can facilitate learning (Rodriguez, 2017).

Students with severe and multiple disabilities experience complex impairments that necessitate intensive support, affecting both their educational participation and social competence (Cole, 2020). Autism spectrum disorder (ASD), encompassing conditions like classic autism, Asperger's syndrome, and PDD-NOS, introduces its own set of challenges, such as delayed language development or social interaction difficulties, requiring tailored strategies to support learning and

behavior (Autism Society, 2023; Centers for Disease Control and Prevention, 2021). These diverse categories of disabilities illustrate the complexity of the educational needs of students with disabilities and the importance of individualized approaches to ensure their success in the classroom.

Following an in-depth review of the various categories of disabilities, researchers have emphasized the significant role that music education plays in supporting the development of children with special needs. Music enhances speech and language abilities by fostering expressive and receptive communication skills, while also developing auditory awareness, discrimination, memory, and appreciation. These skills contribute to conversational competence, particularly as children begin to imitate the rhythms and patterns of spoken language. Music also supports the development of general skills; for instance, playing instruments helps children recognize physical attributes such as size, shape, and color, while also teaching them how to properly hold and handle instruments. These activities promote essential social behaviors, including turn-taking, listening, and cooperative participation in group settings (Adamek & Darrow, 2010). Additionally, music offers a valuable avenue for physical and sensory development through its multisensory nature, which engages the eyes, ears, muscles, and mind. Even when one sensory modality is impaired, music allows children to participate through alternative channels (Campbell & Kassner, 2013). On a neurological level, music stimulates both hemispheres of the brain—the right hemisphere associated with emotion and intuition, and the left associated with logic and sequence. Listening to and playing music activates regions involved in attention, memory, and prediction, thereby supporting cognitive processing (Langer, 2013). Reinforcing these benefits, a study conducted at a Texas university revealed that students who listened to classical music while studying, attending lectures, and sleeping performed better on their exams, highlighting the positive impact of music on academic outcomes (Alize, 2023).

2. Down syndrome

Down syndrome is the most common chromosomal disorder leading to intellectual disabilities, accounting for approximately one-third of all moderate to severe cases. Children with Down syndrome typically exhibit general intellectual impairments, which most often range from mild to moderate in severity (Ahrens, 2023, He et al., 2023). This condition arises from an abnormal chromosomal count, resulting in congenital intellectual disabilities, motor impairments, and various developmental challenges (American Psychiatric Association, 2013). Genetically, Down syndrome is characterized by the presence of an extra copy of chromosome 21, a phenomenon

resulting from an anomaly during fetal development (Dierssen & Torre, 2012). Medically, it is described as a condition in which a person has 47 chromosomes instead of the typical 46, a condition referred to as “trisomy,” specifically Trisomy 21 (Centers for Disease Control and Prevention, 2021). There are three main genetic variations leading to Down syndrome: Trisomy 21, Translocation Down syndrome, and Mosaic Down syndrome, with Trisomy 21 being the most prevalent form, accounting for approximately 95% of cases.

The condition is characterized by delayed physical and cognitive development, which impacts neurological progress, resulting in reduced IQ, delayed language development, memory deficits, and underdeveloped social skills, which are crucial for effective interpersonal interactions (Aziz et al., 2018). Additionally, children with Down syndrome may experience health complications such as hearing loss, gastrointestinal disorders, congenital heart defects, and significant speech and language delays (Newton et al., 2015). Historically, societal understanding of Down syndrome evolved significantly. Early descriptions, such as those by William Harvey in the 16th century, often led to the exclusion and stigmatization of affected individuals (Wright, 2011). However, in the 20th century, legislative reforms like the Individuals with Disabilities Education Act (IDEA) in 1972 paved the way for greater inclusion, ensuring that children with disabilities had access to free, appropriate education in supportive environments (US Department of Education, 2019).

From a cognitive and behavioral standpoint, children with Down syndrome present a wide spectrum of characteristics, including mild to moderate intellectual impairments, as well as potential behavioral challenges such as self-injury, aggression, and non-compliance (Dieleman et al., 2018). Despite these difficulties, many children with Down syndrome demonstrate notable strengths, particularly when supported by strong familial structures. These children often show heightened empathy and emotional expressiveness, though they may still face psychological challenges such as inattention, anxiety, and depression (Eggers & Van Eerdenbrugh, 2018). Additionally, speech fluency issues, including stuttering, affect a significant portion of this population, further complicating their educational experience.

One promising avenue for supporting the development of children with Down syndrome is through enriched educational environments, particularly musical activities. Studies have shown that musical interventions can significantly benefit children with special needs, helping them overcome learning challenges and fostering skill development (Albin, 2016; Imankhah et al., 2018; Kaikkonen & Kivijärvi, 2013; Juntunen, 2020). Hanwei et al. (2023) found that 80% of children with Down syndrome participating in the Music Engagement and Movement (MEM) program acquired essential life skills through singing and physical movement. The enjoyable nature of

music engages these children, building their motivation and self-confidence, and enhancing their perseverance and learning outcomes in the classroom. Thus, the integration of music into educational strategies for children with Down syndrome holds promise for fostering their cognitive, emotional, and social development.

After reviewing the concept of Down syndrome, including its characteristics and the strengths and challenges experienced by children with this condition, the researchers emphasize that the Orff approach provides substantial educational benefits. This approach supports the development of visual learning, reading skills, motor coordination, expressive language, and social competencies in children with Down syndrome. Visual learning plays a vital role in the educational process, yet approximately 70% of children with Down syndrome exhibit visual impairments such as astigmatism (22%), strabismus (57%), myopia, and hyperopia (22%) (Ljubikj, 2010). Given these challenges, the manner in which visual material is presented becomes critical to effective learning. Horstmeier (2016) emphasizes the importance of using videos, images, and movement to enhance comprehension.

In the current study, visual strategies were embedded within the Orff approach through rhythm instruction, such as using the song “Cherry Beet,” and visual reinforcement via interactive tools like the Snakes and Ladders game. Within this game, rhythmic elements such as “Ta” and “Ta Ti” were visually represented and integrated with dice numbers, fostering visual engagement and learning.



[Figure 1] Selected musical activities (Snakes and ladders, Musical ball, Orff instrument, and musical train) conducted with children with Down syndrome as part of the experimental program

Additionally, the Orff approach's integration of music, movement, and play directly supports motor development and expressive language. Through rhythmic exercises and instrument use, children enhance both fine and gross motor skills while also improving self-expression through music and physical movement.

Language delays in children with Down syndrome, often stemming from weak oral muscles and structural features such as a small mouth, large tongue, and narrow palate, can lead to communication frustration, behavioral issues, and cognitive limitations (Horstmeier, 2016). These children frequently struggle to express knowledge they already possess, leading to misconceptions about their cognitive abilities. Research indicates that they can rapidly learn sign language, which can serve as a bridge to verbal expression. Wright (2011) suggest that integrating hand gestures with spoken language in play-based learning contexts enhances communication outcomes. Furthermore, the collaborative nature of the Orff approach fosters the development of essential social skills, including turn-taking, listening, sharing, and idea expression, through group-based musical games and ensemble participation. Overall, the Orff approach presents a multifaceted and inclusive educational strategy that aligns well with the diverse developmental needs of children with Down syndrome.

3. The Orff approach (Orff Schulwerk)

The Orff approach, also known as Orff Schulwerk, has been interpreted as a method, philosophy, curriculum, or theory, and is grounded in the principles of play, activity, discovery, creativity, improvisation, participation, and collaboration. It emphasizes the use of the human voice as the primary melodic instrument, promoting precise vocal training and fostering respect for one's voice in parallel with musical instruments, thereby aiding pronunciation and linguistic intelligence (Toksoy, 2014). Central to Orff's philosophy is the belief that children naturally learn through play rather than traditional work, making it essential for music classrooms to be engaging and inclusive, particularly for children with special needs (Gökçe, 2007). Key elements of the Orff approach include rhythm, which forms the basis of musical and bodily expression; language, which supports the acquisition of musical and expressive skills through songs and chants (Webster, 2015); movement, which enhances rhythmic competence and creative expression (Sarıkavak, 2022); and music, which should reflect children's experiences and often utilizes simple folk songs for accessibility. Play is considered the optimal method for music instruction, encouraging creativity, cooperation, and social development, while singing promotes holistic

growth across social, motor, emotional, and intellectual domains (Awda, 2018). Orff instruments, such as tuned percussion (e.g., xylophones, metallophones), recorders, and untuned percussion (e.g., drums, tambourines, woodblocks), offer a hands-on, interactive way for children to learn music and express themselves creatively (Gökçe, 2007; Taranto, 2010). Additionally, body percussion—such as snapping, clapping, tapping, and stamping—serves as an accessible means of reinforcing rhythm and physical coordination (Awda, 2018). Unlike rigid curricular models, the Orff approach offers flexibility, allowing teachers to adapt lessons to the interests and developmental levels of their students, with a strong emphasis on collaborative and experiential learning (Edtrella, 2023). Its instructional techniques include recitation, which involves repeating musical elements with physical engagement (Rob, 2023); echo play, a call-and-response format that fosters imitation and musical memory (Sarrazin, 2016); the ostinato technique, involving repeated melodic or rhythmic patterns to establish musical foundations (Jacobus, 2009); and the bordun technique, which uses repetitive accompaniments in open fifths or octaves to support improvisation and ensemble performance. Together, these components make the Orff approach a dynamic and inclusive music education strategy, particularly effective for supporting diverse learners, including those with special needs.

Based on the preceding discussion, it is evident that the elements of the Orff approach—rhythm, melody, movement, language, play, and the use of Orff instruments—are deeply interconnected, forming an integrated educational system that fosters comprehensive musical learning. The rhythmic patterns found in language, particularly through rhymes and speech rhythms, help students grasp the concept of rhythm, while movement reinforces these rhythms and connects them to singing. Musical games, in turn, link singing and movement, making the learning experience more engaging and cohesive. Playing Orff instruments acts as a unifying element that activates and harmonizes all the other components, enhancing students' musical readiness and participation. Through the implementation of this approach in the current study, researchers observed several notable outcomes: it reduced anxiety and encouraged emotional expression, improved mood and coping mechanisms, and served as an effective tool for music therapy among children with Down syndrome. Furthermore, the approach utilized multisensory experiences and structured musical activities that promoted a sense of achievement, while the inclusion of varied song types contributed to the development of musical appreciation and the reinforcement of skills acquired during the learning process.

4. Orff instruments

Playing Orff instruments is a fundamental component of group musical activities for children with Down syndrome, as it fosters participation, enhances auditory discrimination, and improves sensorimotor coordination. These activities help children distinguish between high and low pitches as well as loud and soft sounds, while also training them to follow rhythmic patterns and improving cognitive skills such as memory, attention, and concentration. Additionally, the use of Orff instruments supports the development of positive behavioral traits like cooperation, self-confidence, and independence (Elias, 2021). The primary Orff instruments include the xylophone, triangle, castanets, maracas, jingle bells, and tambourine. The xylophone, derived from the Greek words for “wood” and “sound,” consists of wooden or metal bars that are struck with mallets to produce varied tones depending on size and material (Ibrahim, 2024). The triangle, a bent steel rod shaped into an open triangle, is played by striking it with a metal beater to create rapid, resonant tones (Ibrahim, 2024). Castanets, rooted in Spanish folk traditions, are hollow wooden shells that produce clicking sounds when shaken or pressed together and are often used in rhythmic dance (Ismail, 2022). Maracas, originating from pre-Columbian cultures, are rattles filled with seeds and shaken in coordinated motion to produce rhythmic sound (Blades & Schechter, 2004; Ismail, 2022). Jingle bells consist of small, spherical bells attached to a handle or strap, and are shaken to create rhythmic jingling sounds (Blades & Holland, 2004; Ismail, 2022). Finally, the tambourine, a frame drum with a single skin head and metal jingles, is played by striking the center and edge to produce different tones and maintain rhythm (Blades & Holland, 2004). These instruments, due to their accessibility and variety, not only make musical learning enjoyable and interactive but also promote comprehensive development for children with special needs.

During the study, the researchers found that training children with Down syndrome to play Orff instruments, such as the triangle, tambourine, jingle bells, maracas, and xylophone, positively impacted several areas of development. The use of these instruments helped maintain rhythmic units, execute diverse rhythmic patterns, and perform simple rhythmic exercises, which enhanced both motor coordination and auditory perception. Participants improved their fine motor skills through tasks like finger movements on the xylophone and gross motor skills through larger actions, such as playing the tambourine. Additionally, the instruments promoted auditory discrimination, enabling children to distinguish between high and low pitches, and loud and soft rhythms. The study also observed improvements in social behaviors, such as increased cooperation, reduced shyness, and greater self-reliance. The researchers emphasized introducing

one instrument at a time to prevent overwhelming the participants, suggesting a gradual approach for introducing additional instruments as confidence grows. Furthermore, providing opportunities for students to experiment with instruments and choose their preferred instrument during group singing sessions fostered engagement and a sense of independence.

III. Methods

1. Research methodology

The current research adopts both descriptive and experimental methodologies. the descriptive methodology was employed to prepare the program based on the Orff approach for developing the skills of playing Orff instruments among children with Down syndrome, review previous studies and literature related to musical skills and children with Down syndrome, design an observation checklist for Orff instruments skills, and analyze and interpret the research results. The experimental methodology was applied to investigate the effectiveness of the program based on the Orff approach in developing the skills of playing Orff instruments among children with Down syndrome.

2. Experimental design of the study

The researchers used a single-group experimental design (pre-test and post-test). Means, standard deviations, and the t-test were calculated for the experimental group to determine the differences between pre-test and post-test scores.

The program consisted of 20 weekly lessons, each lasting 60 minutes, during the 2022–2023 academic year. The lessons were organized into four progressive stages designed to enhance the use of Orff instruments among children with Down syndrome. Following the Orff approach, the sessions combined rhythm training, singing, movement, and musical games.

3. Research hypotheses

In light of the results of previous research and studies, as well as the research objectives, the following hypotheses were formulated: There is a statistically significant difference at the

level of ($\alpha \leq .05$) between the mean ranks of the scores of children with Down syndrome taught using the Orff approach in the pre-test and post-test applications of the observation checklist for Orff instruments skills (as a whole) and for each sub-skill.

4. Research sample

The research sample included 11 children with Down syndrome (3 male, 8 female), age range (18-30), residing at the Al-Falak Charity Foundation in Akwa Al-Hissa, Kafr El-Zayat, Tanta, Gharbia, during the academic year 2022–2023.

5. Research tools

The intervention tools included a teacher's guide for Orff instruments skills for children with Down syndrome, (prepared by the researchers). The research tools consisted of an observation checklist for Orff instruments skills for children with Down syndrome also prepared by the researchers.

1) Observation checklist for Orff instrument skills validity

The current research employed two methods to verify the validity of the observation checklist for Orff instruments performance skills among individuals with Down syndrome: Content validity and internal consistency validity.

(1) Content validity

To ensure content validity, the initial version of the observation checklist for Orff instruments performance skills among individuals with Down syndrome was reviewed by a group of specialists. Their opinions were sought regarding the scientific phrasing of the items, the logical sequence of the statements, the alignment of the items with the objectives, and their relevance to the content. Based on the feedback received, the researchers revised the wording of several items accordingly. As a result, the checklist was subjected to content validity procedures and finalized to include 38 items. The following table presents the agreement coefficient for the observation checklist related to Orff instruments performance skills.

<Table 1> Agreement coefficient for the observation checklist for Orff instruments performance skills

Evaluation criteria	Number of agreements	Number of disagreements	Agreement coefficient
Accuracy of linguistic phrasing of the statements	5	0	100
Clarity and simplicity of the statements	5	1	83.33
Appropriateness of the number of items per dimension	6	0	100
Logical sequence of the statements within each dimension	5	1	83.33

The researchers employed the method of inter-rater agreement among six experts to calculate the reliability of the raters in determining the evaluation criteria. Each expert independently recorded their observations without consulting the others. The number of agreements among the raters was calculated using Cooper's formula: Agreement percentage = (Number of agreements / (Number of agreements + Number of disagreements)) × 100. The resulting agreement percentages ranged between 83.33% and 100%, which are considered high and acceptable levels of agreement.

(2) Internal consistency validity

The checklist was applied to a pilot sample consisting of five individuals with Down syndrome. Following the application, the internal consistency validity of the items was assessed using Cronbach's Alpha coefficient to calculate the overall reliability and item validity. This method is based on the internal consistency model, which relies on the average inter-item correlation between the individual items and the overall observation checklist for Orff instruments performance skills. The resulting overall reliability and item validity coefficient was .876, indicating a high level of reliability.

The following table presents the Pearson correlation coefficients between the sub-items and the total score of the observation checklist for Orff instruments performance skills among individuals with Down syndrome.

<Table 2> Pearson correlation coefficients between sub-items and the overall observation checklist for Orff instruments performance skills

Skill area	Item	Correlation coefficient	Item	Correlation coefficient	Item	Correlation coefficient
Individual and group performance skills on the tambourine	1	.88**	2	.63**	3	.77**
	4	.64**	5	.73**	6	.80*
	7	.74**				
Individual and group performance skills on the triangle	1	.76**	2	.86**	3	.75**
	4	.81**	5	.88**	6	.61**
	7	.77**	8	.72**		
Individual and group performance skills on the maracas	1	.86**	2	.82**	3	.61**
	4	.70**	5	.86**	6	.44**
	7	.82**	8	.54**		
Individual and group performance skills on the handled castanet	1	.84**	2	.77**	3	.54**
	4	.74**	5	.74**	6	.51*
	7	.76**				
Individual and group performance skills on the xylophone	1	.85**	2	.76**	3	.50**
	4	.57**	5	.60**	6	.52**
	7	.56**	8	.54**		

*p<.05, **p<.01

By examining the above table, it is evident that all the correlation coefficients between each item and the overall observation checklist for Orff instruments performance skills are strong positive correlations, all of which are statistically significant at the .01 level. Based on these results, it can be concluded that the sub-items demonstrate a high degree of internal consistency within the observation checklist for Orff instruments performance skills.

2) Reliability of the observation checklist for Orff instruments performance skills:

To assess the reliability of the observation checklist for Orff instruments performance skills, the checklist was applied to a sample of five participants. The reliability was calculated using two methods: Test-Retest Reliability, Split-Half Reliability.

(1) Test-retest reliability

The test-retest method was used to calculate the reliability coefficient of the observation checklist. The researchers applied the checklist to a sample of five individuals with Down syndrome, and then reapplied it after a three-week interval. The statistical analysis was conducted using the SPSS software, version 21. The reliability coefficient for the overall checklist was .833, indicating a high level of reliability. This suggests that the results provided by the checklist are trustworthy and that it can be reliably used as a research instrument.

The split-half reliability method was also applied. This method involves administering the checklist once and then dividing it into two equivalent halves. The correlation coefficient between the scores of the two halves is then calculated. Based on this, the predicted reliability coefficient for the full checklist was estimated to evaluate the consistency of the observation checklist for Orff instruments performance skills.

<Table 3> Reliability coefficient using split-half method for Spearman/Brown and Guttman

Guttman	Spearman/Brown	
	Unequal length	Equal length
.88**	.87**	.88**

*p<.05, **p<.01

It is evident that the total reliability coefficient for the Orff instruments skill observation checklist using the Spearman/Brown Split-Half method equals (.876) in the case of equal test halves, and (.874) in the case of unequal test halves. Furthermore, the total reliability coefficient for the Orff Instruments Skill Observation Checklist using the Guttman Split-Half method equals (.876), indicating a high total reliability coefficient. Based on the above, the final version of the Orff instruments skill observation Checklist consists of (38) items.

IV. Results

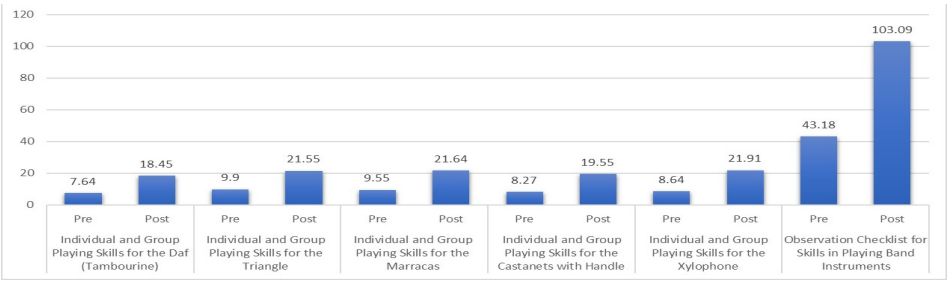
To verify the validity of the research hypothesis, which states: There is a statistically significant difference at the level ($p \leq .05$) between the mean ranks of the scores of the Down syndrome participants, taught using the Orff approach, in the pre- and post-application of the observation

checklist for skills in playing Orff instruments.' The results of applying the observation checklist in both the pre- and post-assessments were analyzed for the Down syndrome participants. The means and standard deviations of the Down syndrome participants' scores in both the pre- and post-assessments of the observation checklist were calculated, and the following table summarizes these results.

<Table 4> Means and standard deviations of the scores of down syndrome participants in the pre- and post-applications of the observation checklist for skills in playing Orff instruments

Component	Type of performance	Mean	Standard deviation
Individual and group playing skills for the daf (tambourine)	Pre	7.64	.81
	Post	18.45	1.86
Individual and group playing skills for the triangle	Pre	9.9	1.14
	Post	21.55	1.75
Individual and group playing skills for the marracas	Pre	9.55	1.37
	Post	21.64	1.96
Individual and group playing skills for the castanets with handle	Pre	8.27	1.10
	Post	19.55	1.13
Individual and group playing skills for the xylophone	Pre	8.64	.81
	Post	21.91	1.38
Observation checklist for skills in playing Orff instruments	Pre	43.18	3.19
	Post	103.09	3.30

It is evident from the results summarized in the previous table that there is an improvement in post-performance; this is inferred from the comparison of the means and standard deviations of the pre- and post-assessments.



[Figure 2] The mean scores of individuals with Down syndrome in the pre- and post-application of the observation checklist for Orff instruments playing skills

The Wilcoxon Signed Rank Test was applied, which is a non-parametric test used as an alternative to the t-test for related samples when the conditions for using the t-test for paired data are not met, due to the small sample size. The following table summarizes these results.

<Table 5> The value of 'z' and its statistical significance for the difference between the mean ranks of the Down syndrome participants' scores in the pre- and post-applications of the observation checklist for skills in playing Orff instruments and for each of its sub-skills

Component	Sign ranks	N	Mean ranks	Sum of ranks	Z statistic	Significance level	Rank-biserial correlation coefficient (effect size = rprb)
Individual and group playing skills for the daf (tambourine)	Negative	0	.00	.00	2.956	.003	1.00 (Very strong)
	Positive	11	6.00	66.00			
	Tied	0					
Individual and group playing skills for the triangle	Negative	0	.00	.00	2.952	.003	1.00 (Very strong)
	Positive	11	6.00	66.00			
	Tied	0					
Individual and group playing skills for the marracas	Negative	0	.00	.00	2.949	.003	1.00 (Very strong)
	Positive	11	6.00	66.00			
	Tied	0					
Individual and group playing skills for the castanets with handle	Negative	0	.00	.00	3.020	.003	1.00 (Very strong)
	Positive	11	6.00	66.00			
	Tied	0					
Individual and group playing skills for the xylophone	Negative	0	.00	.00	2.988	.003	1.00 (Very strong)
	Positive	11	6.00	66.00			
	Tied	0					

<Table 5> Continued

Component	Sign ranks	N	Mean ranks	Sum of ranks	Z statistic	Significance level	Rank-biserial correlation coefficient (effect size = rprb)
Observation checklist for skills in playing Orff instruments (as a whole)	Negative	0	.00	.00	2.943	.003	1.00 (Very strong)
	Positive	11	6.00	66.00			
	Tied	0					

**p<.01

It is evident from the results summarized in the previous table that the Z statistic value is significant at the .01 level, indicating a statistically significant difference between the mean ranks of the Down syndrome participants' scores in the pre- and post-applications of the observation checklist for skills in playing Orff instruments (as a whole) and for each of its sub-skills—favoring the post-performance. Therefore, the researchers can accept the hypothesis, which states: There is a statistically significant difference at the level ($p \leq .05$) between the mean ranks of the Down syndrome participants taught using the Orff approach in the pre- and post-applications of the observation checklist for skills in playing Orff instruments favoring the post-application.

V. Discussion

The findings of this study demonstrate that a training program based on the Carl Orff approach significantly enhanced the musical skills of children with Down syndrome, particularly in their ability to play Orff instruments. Statistically significant improvements between pre- and post-test scores, along with a large effect size, indicate that the program was highly effective in addressing the performance challenges identified at the outset. These challenges included difficulties in maintaining attention, controlling gross and fine motor skills, and achieving sensorimotor coordination. The outcomes suggest that systematic engagement in rhythm, movement, singing, and instrument playing can serve as powerful tools for improving motor coordination, sustaining attention, and promoting expressive participation.

Several educational and developmental mechanisms may explain these results. The lessons were designed progressively, beginning with simple rhythms and gradually introducing additional instruments, which minimized cognitive overload and supported consistent engagement. Musical

games, such as musical ball, musical ladder and snake, and musical train, not only reinforced rhythmic accuracy but also fostered social interaction, decision-making, and cooperative behavior, addressing common areas of difficulty for children with Down syndrome. The structured teacher's guide, combined with formative and summative assessments, ensured instruction was responsive to individual progress and allowed for adaptive learning within the group context.

The stepwise lesson progression—from introductory sessions with basic rhythms to advanced songs and post-assessment—highlighted the benefits of experiential learning and repeated practice. Children improved in performing rhythmic units, using Orff instruments (triangle, tambourine, maracas, castanets, xylophone), and coordinating movement with singing, reflecting the effectiveness of multisensory, Orff-based activities. Engagement and joy increased when children combined songs with movement, hand signs, and musical games, confirming the role of playful and interactive approaches in promoting skill acquisition.

These findings align with previous studies that reported the effectiveness of Orff-Schulwerk-based music programs for children with disabilities (Choi, 2013; Clark, 2011; Eren, 2014; Filianou & Stamatopoulou, 2013; Hanwei, Poon, & Cheong, 2023; Pektaş, 2019). However, the present study extends this work by focusing specifically on children with Down syndrome and by providing detailed evidence of improvement across multiple sub-skills of Orff instrument playing. From an educational perspective, the results underscore the importance of integrating arts-based pedagogies into special education curricula. The Orff approach offers a culturally adaptable, developmentally appropriate method for supporting both musical and non-musical growth, including cognitive, motor, and social development.

Despite these promising results, the study has some limitations. The sample size was small and drawn from a single institution, limiting generalizability. The research design did not include a control group, which constrains the ability to attribute improvements solely to the intervention. Additionally, the study focused on musical skills and did not directly measure broader developmental or life skills. Future research should employ larger, more diverse samples, experimental designs with control groups, and longitudinal assessments to examine the maintenance of gains and potential transfer to other areas of learning and daily life.

VI. Conclusion

In conclusion, this study provides strong evidence that a structured Orff-based program can

effectively enhance the musical skills of children with Down syndrome, improving their performance on Orff instruments and supporting engagement, coordination, and expressive participation. The program's emphasis on rhythm, movement, singing, and playful musical games contributed to its effectiveness, demonstrating the potential of arts-based pedagogies in special education. These findings suggest that such programs can serve as valuable tools not only for music development but also for broader educational, cognitive, and social growth. It is recommended that music educators and special education practitioners consider incorporating Orff-based activities into curricula, and that future studies investigate long-term impacts, scalability, and adaptability across diverse educational settings to further support the holistic development of children with intellectual disabilities.

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