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The Impact of Integrating Musical and Image Technology upon the Level of Learning Engagement of Pre-School Children

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Abstract: This study aimed to evaluate the impact of music technology on the attitudes and engagement level of preschool children. The desired outcome of the study is to formulate recommendations to improve the teaching curriculum through the use of physical activities at the preschool level. The strategy tested involved integrating technology, music, and images into children's physical activities to enhance their willingness to learn, preference, and motor skills. The study used music and images created through technology instruments to stimulate multiple senses, including vision, hearing, and touch sensations. It was expected to enhance learning interests and motor skills among children in physical activities. The innovative courses were developed jointly by qualified and senior preschool teachers, a physical fitness trainer, and a music therapist. The regimen involved a set of lesson plans combining music technology with physical training for children. The study used 64 healthy children who were 5 years old and studied at a private preschool in Taiwan, who were divided into an experimental group that implemented the innovative courses and a control group that adopted traditional teaching. The physical training courses were implemented twice a week, with 45 min per session for 18 weeks. The results revealed a significant enhancement in the concentration, preference, and willingness of participation among children in the experimental group after participation in the course. However, these effects were not observed and were not found among the children in the control group. Additionally, it was also found that the positive impact of enhanced motor skills, such as dynamic balance, hopping, and jumping, was significantly better among children in the experimental group than those in the control group. Consequently, this research study supports the integration of music technology and images into physical courses for children. Clinically, it indicates a significantly improved enhancement effect towards learning mentality and motor skills among children. This innovative teaching approach suggests a high probability to substantially assist the preschool's course management strategy and methodical learning effects.

Keywords: music technology; motor skills; preschool children; course management strategy; integrated teaching

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1. Introduction

The pursuit of quality and efficiency of education has been the focus of much educational research [1–3]. It has become a crucial issue for many educational experts and scholars to study how to improve educational methods to improve the quality of education and meet the needs of students [4–7]. Scholars [4] believed that current educational styles would be very unpredictable if massive defects existed in educational methods and knowledge. They encouraged educational systems to implement effective educational strategies to enhance academic service quality in order to meet expected results. The quality of instructional delivery affects satisfaction among students, while students' satisfaction is closely related to their academic performance. Therefore, it is essential to enhance teachers' instructional qualities, students' capabilities, and the communication abilities of all involved [8].

Some studies have found the methods or factors for enhancing preschool education quality. For example, Scholars [9] supported the idea that innovative education technology should be introduced to future teachers' professional training at early childhood education preparatory institutions. A study [10] confirmed that the preschool teachers' classroom behaviors provide opportunities for developing ability, self-efficacy, and a sense of belonging for children. Further, teachers have a decisive impact on enhancing active participation from children.

A study [11] explored whether preschool children's emotional regulation, problem behaviors, and behavioral self-regulation can be used as predictable factors for indicating kindergarten achievement scores. Results revealed that children's emotional regulation and behavioral self-regulation in class are all related to academic achievement. Indeed, negative preschool experiences influence behavioral self-regulation, impacting emotional behaviors and academic achievement in such a manner that carries through to kindergarten from preschool. A scholar [12] pointed out the Singaporean government's emphasis on improving preschool education (PSE) and encouraging a successful start for each child. It was suggested to enhance the quality of teachers, centers, and courses, and to advance the affordability and accessibility of PSE.

Scholars [13] investigated how social transformation and globalization have shaped the early childhood curriculum. Through interviews, observations, and documents, an investigation was carried out on school-based curriculum development (SBCD) at two preschools in Shenzhen to understand the reasons for course innovation and SBCD at preschools in China. The study showed that the curriculum for each case was an integrated system balancing different curriculum approaches. Cultural conflict and integration were also found during dynamic curriculum transformation. Social change was reflected in the contradictive motivation; for example, child-centeredness versus teacher-directedness, individualism versus collectivism, and imported versus local approaches played decisive roles in SBCD strategies. Some scholars, however, have questioned the relationship between curriculum and early childhood performance. Scholars [14] explored pre-kindergarten instruction in terms of early childhood education. They found almost no correlation among the indexes of teachers' education, professionalism, certification, curriculum quality, and children's performance.

Early childhood research indicates a significant relationship between social relationships and motor competencies [15], proving the impact of motor skills on child development. Therefore, many studies focus on investigating how to enhance motor or activity skills in childhood education. For instance, Scholars [16] used Palestine to explore which intervention measures can improve children's health conditions in school life through physical activity among preschool children in different educational circumstances. The results found that preschool children rarely engage in total physical activity and moderate–vigorous physical activity when in class. Compared to sessions without structured movement, children presented significantly higher MVPA standards during days with structured movement sessions. The contribution to MVPA during the structured movement sessions was substantially higher than days without them. The high-density children in the playground were related to high-standard energetic PA. Some actual results from this study could be used for physical activity recommendations for preschoolers.

Generally speaking, the intervention and improvement strategy towards motor skills has proved to have an existing and positive impact on the development of fundamental motor skills (FMS) among preschool children [17,18]. A study [19] studied the Early Childhood Education and Care (ECEC)-based physical activity interventions on children aged between 3 and 5. These offered more opportunities for children to participate in sports activities. The result revealed the critical and significant changes in physical activity outcomes among the participating children. It is suggested that when engaged in developing intervention measures, elements as curriculum, administrative requirements, and quality of educational workers must be taken into consideration and efforts to develop creative and unique educational approaches. A scholar [20] proposed the impact of motor skills among preschool children with innovative sports plans. His research demonstrated significantly better motor skills for these children than for those with general sports plans.

Scholars [21] support the idea that the combination of music and sports can significantly enhance specific skills for more complicated sports (such as gymnastics). In sports, playing music in the background has been shown to help sports experiences and achieve significant positive impacts [22]. Scholars [23] backed up the notion that electronic music with piano tones via MIDI-piano or programming can enhance the effect of sports skills training, especially showing a significant improvement in speed enhancement, as well as the accuracy and stability of movement. Therefore, it is believed that music-supported training achieves a better improvement in motor skills than constraint-induced therapy.

A study [24] believed music training in childhood might enhance some complicated movements. Scholars [25] investigated the integration of music into childhood education in sports activities and found that the integration of music into sports activities demonstrated a significant and positive effect on motor skills, such as galloping, leaping, horizontal jumping, and skipping; consequently, they supported the development of training courses related to the combination of music and sports activities. Scholars [26] pointed out that the proper adoption of music into sports training generated significantly enhanced effects on motor skills, such as jumping and dynamic balancing, among preschool children. A study [27] considered that rhythm sensation was closely related to children's motor coordination, and they advocated for special rhythm activities to be included in the preschool physical curriculum.

Although the literature study confirmed the impact of music on children's motor skills, the result towards learning attitudes and behaviors among children was not further discussed, especially in learning willingness and concentration. Under the background of the COVID-19 pandemic, the study integrated technically novel music and images into traditional physical activities in order to explore their impact on motor skills and learning mentality among preschool children through innovative teaching modes for physical activity for children. This study's results help to clarify the pre-evaluation and reference carried out on the preschool owner's effectiveness of future curriculum development strategies; this is recommended by implementing an integrated teaching approach that combines the use of technological instruments with cross-curricular combinations.

2. Materials and Methods

The study results aimed to enhance children's learning willingness, preferences, and effectiveness by integrating traditional childhood education with physical activities. Technologically based music and image processing equipment were used to design a set of melody and images for teaching; these were integrated into original physical activities for children to improve an original teaching mode for physical activities closely focused upon the teacher's instruction and movement as directed. With the integration of music and images into their physical courses, preschool children later could develop their motor skills through lively and novel melodies and images when engaging with physical activities, without the need of following the teacher's instruction.

Figure 1 shows types of teaching equipment used in this study. Figure 1a is Talking Cube and Stair, which are instruments with audio, recording, and contact (collision) switching functions that allow for elastic changes, depending on the need, for physical activity. The cube is a large dice which, when thrown, has different instructions and melodies on each side; the operator can then copy the movements, such as targeted throws or kicks, and other training. When a young child climbs the stairs, command movements and melodies (twisting and stretching) are obtained after touching the (collision) switch through the foot or hand. Figure 1b is a Musical Jumping Pad to meet the needs of multi-sensory learning, including hearing, vision, motion, body balance, and operational physical training programs. While jumping on the pad, it emits sounds and commands that can provide young children hearing stimulation that works with the operation of physical activity. The sounds can be combined with the wall display screen to combine hearing and vision. Children can control the displayed colors on the screen to meet their satisfaction. This device is available for jumping or stamping to promote movements and maintain a sense of body balance.

Figure 1. Teaching equipment in the study. (**a**) Talking Cube & Stairs; (**b**) Musical Jumping Pad; (**c**) Circular Set of Musical Lights; (**d**) Khoros Musical Pad.

Figure 1c shows a Circular Set of Musical Lights, a set of equipment for training participants' gross and fine motor skills by manipulating the participants' limbs, such as using body movements to trigger the device and produce different sounds light sources. Sound patterns with various effects can be linked to hearing, vision, and motion to enhance learning motivation. Figure 1d shows a Khoros Musical Pad, composed of eight colors (pink, red, orange, yellow, green, light blue, dark blue, purple). It can be performed in a walking or jumping manner to promote the development of gross motor skills in children. It emits bright light to attract children's attention. At the same time, it can emit Do, Re, Mi, Fa, Sol, La, Si, Do (high), and the sound can be recorded by itself as required. Figurenotes uses simple graphics and color pairings to learn notes and incorporate notes into a game project to perform a physical action (e.g., running and jumping, etc.), with different graphics and color pairings to recognize different musical melodies and physical activity movements.

The subjects used in the study were healthy children aged over 5 and studying at preschools in Taiwan. Purposive sampling was used to select 64 participants. Under the condition of no character differentiation between the groups (refer to the result of the Kruskal-Wallis test shown in Table 2), the children were divided into the experimental group and the control group, each with 32 participants, 16 boys and 16 girls. The experimental group children were given an innovative course of music combining with physical activities for 45 min each session and twice a week from 1 August 2019, for 18 weeks. The control group children were given traditional physical activities during the same period.

Other than collecting the basic information of each child before implementing physical activities, including age, gender, height, and weight, each child's measured values before and after physical activity performance were also collected. Among them, the items of indicator included: 1. learning mentality [28]: (1) concentration; (2) preference towards physical activities (scored 1~5); (3) learning willingness (scored 1~5). 2. Motor skills (Zachopoulou et al., 2004 [26]): (1) dynamic balance; (2) hopping—10-meter turnback run; (3) jumping—standing long jump. Lastly, the collected basic information and the pre-values and post-values of measured items were tested using basic statistics, a test of difference on average and distribution in the experimental group and the control group—t-statistic and Kruskal–Walls test, and matched-pairs differential analysis (paired *t*-test and Wilcoxon matched-pairs signed-ranks tests). The research hypothesis related to the tests is as below:

Hypothesis 1 (H1). *No difference existed in the average value of measuring index in the experimental and control groups before implementing the physical course.*

Hypothesis 2 (H2). *No difference existed in the distribution of measuring index in the experimental and control groups before implementing the physical course.*

Hypothesis 3 (H3). *The post-test average value of the measuring index is significantly better than its pre-test average among the children in the experimental group after implementing the physical course.*

Hypothesis 4 (H4). *The post-test average value of the measuring index is significantly better than its pre-test average among the children in the control group after implementing the physical course.*

Hypothesis 5 (H5). *The average changing standard of the measuring index among children in the experimental group is significantly better than that in the control group after implementing the physical course.*

3. Results

Table 1 shows the basic statistics, and it contains the average value (mean) and standard deviation (S.D.) of the measuring indices before participating in physical activity training in the whole sample (N = 64), boys (N1 = 32), and girls (N2 = 32). The items include age, height, weight, attention, preference, willingness to participate, balance beam, 10-meter turnback run, and standing long jump. Table 2 shows the average value and standard deviation for age, height, weight, attention, preference, willingness to participate, balance beam, 10-m turnback run, and standing long jump measured before participating in the physical activity training among the children in the experimental group and the control group, respectively. Moreover, we assumed no significant difference existed in the average value of the measuring index in both the experimental group and the control group before the implementation of the course by the paired *t*-test (H1) as well as assumed that no difference existed on the distribution of the measuring index for both the experimental group and the control group before implementation of the course by the Kruskal–Wallis test result (H2). Under the 5% significance level, the testing result of Levene in Table 2 supports that no considerable difference (equality acceptance) existed in the variables of the pre-measurement value for the nine indicators in the experimental group and the control group, meaning that the research H2 is true. Next, there no difference existed in the average value of the pre-measurement value of the nine indicators in the experimental group and the control group supported by paired *t*-test ; this meant that the research H1 is true. The Kruskal–Wallis test result supported there being no difference in the distribution of the nine indicators in the experimental and control groups before implementing the course. Finally, the test, under the situation of both hypotheses H1 and H2 being true, revealed no significant difference in the nine indicators before both the experimental group and control group participated in the physical activity training. This proves that the grouping of the samples met the condition that no difference existed between the groups.

Table 1. Basic statistics (Obs. = 64).

Measuring Index	Whole Sample		Boy		Girl	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Age (year)	6.0938	0.4225	6.0781	0.4010	6.1094	0.4487
Height (cm)	115.8125	4.1543	115.5625	4.3306	116.0625	4.0236
Weight (kg)	22.0234	3.2138	22.8438	3.2390	21.2031	3.0184
Attention (score)	6.5000	3.0602	5.7813	2.9701	7.2188	3.0239
Preference (score)	3.5313	0.6416	3.4063	0.7121	3.6563	0.5453
Willingness to participate (score)	2.8906	0.7372	2.8438	0.7666	2.9375	0.7156
Balance beam (sec)	22.2077	3.9858	21.6344	4.0436	22.7809	3.9059
10-m-turnback run (sec)	11.0342	1.4385	11.0281	1.6217	11.0403	1.2552
Standing long jump (cm)	84.4655	14.6778	90.6722	12.9613	78.2588	13.7948

Table 2. Descriptive statistics and the different analyses for the experimental and control groups (Obs. = 64).

Measuring Index	Group	Basic Statistics		Levene's Test	*t*-test with Equal Mean		Kruskal-Wallis Test	
		Mean	S.D.	F-Test (*p*-Value)	Average Difference	*t*-test (*p*-Value)	Hypothetical Distribution	*p*-Value
Age (year)	Experimental	6.0547	0.4210	0.124	−0.0781	−0.737	Same #	0.366
	Control	6.1328	0.4270	(0.726)		(0.464)	Different	
Height (cm)	Experimental	115.4844	4.3002	0.094	−0.6563	−0.629	Same #	0.253
	Control	116.1406	4.0446	(0.760)		(0.532)	Different	
Weight (kg)	Experimental	22.1406	3.2633	0.198	0.2344	0.290	Same #	0.835
	Control	21.9063	3.2115	(0.658)		(0.773)	Different	
Attention (score)	Experimental	6.5313	3.1519	0.117	0.0625	0.081	Same #	0.941
	Control	6.4688	3.0159	(0.734)		(0.936)	Different	
Preference (score)	Experimental	3.5938	0.6148	0.384	0.1250	0.777	Same #	0.712
	Control	3.4688	0.6713	(0.538)		(0.440)	Different	
Willingness to participate (score)	Experimental	2.9063	0.7344	0.084	0.0313	0.168	Same #	0.840
	Control	2.8750	0.7513	(0.773)		(0.867)	Different	
Balance beam (sec)	Experimental	22.2581	4.1979	1.540	0.1009	0.100	Same #	0.925
	Control	22.1572	3.8285	(0.219)		(0.920)	Different	
10-m-turnback run (sec)	Experimental	11.0206	1.4957	0.329	−0.0272	−0.075	Same #	0.936
	Control	11.0478	1.4029	(0.569)		(0.940)	Different	
Standing long jump (cm)	Experimental	83.8909	15.7606	0.965	−1.1491	−0.311	Same #	0.898
	Control	85.0400	13.7385	(0.330)		(0.757)	Different	

Note: * $p < 0.05$; ** $p < 0.01$; # represent the accepted assumption.

Table 3 demonstrates the difference between the post-measured value and the experimental group's measuring index's pre-valued value. It mainly used paired sample average difference *t*-test and Wilcoxon's statistics z test to infer whether the research hypothesis (H3) was true; that is, supporting the post-measured value of the measuring index among the children in the experimental group after the implementation of physical courses was significantly better than the pre-measured value before the implementation. The result in Table 3 shows the average difference (post-measured value minuses the pre-measure value) in attention, preference, and willingness to participate are 1.0625 (p-value in t-test = 0.000 < 0.01; p-value in Wilcoxon's statistics z-test = 0.000 < 0.01), 0.5000 (p-value in t-test = 0.000 < 0.01; p-value in Wilcoxon's statistics z-test = 0.001 < 0.01), and 0.5313 (p-value in t-test = 0.000 < 0.01; p-value in Wilcoxon's statistics z-test = 0.000 < 0.01), respectively. This reveals that the children in the experimental group significantly enhanced their learning mentality in attention preference and willingness to participate after the innovative physical courses. Moreover, the average difference in balance beam, 10-m turnback run, and standing long jump are −2.0425 (p-value in t-test = 0.000 < 0.01; p-value in Wilcoxon's statistics z-test = 0.000 < 0.01), −1.5788 (p-value in t-test = 0.000 < 0.01; p-value in Wilcoxon's statistics z-test = 0.000 < 0.01), and 5.9250 (p-value in t-test = 0.000 < 0.01; p-value in Wilcoxon's statistics z-test = 0.000 < 0.01), respectively. These results reveal that children in the experimental group were able to significantly enhance their motor skills in dynamic balance, hopping, and jumping after participating in the innovative course of music integrated into physical training. Finally, the testing result of the six measuring indices supported our view that the post-measured value of the measuring index would be better than the pre-measured value after the children in the experimental group were given innovative courses; therefore, we can assume that the research H3 is true.

Table 3. Comparison of the post- to pre-measurement value on the experimental group (Obs. =32).

Measuring Index	Measurement Period	Basic Statistics		Paired Difference Test (Post-to-Pre)		Kruskal–Wallis Test
		Mean	S.D.	Average Difference	t-test (p-Value)	z-Test (p-Value)
Attention (score)	Post	7.5938	3.0359	1.0625	6.849 **	−4.327 [b] **
	Pre	6.5313	3.1519		(0.000)	(0.000)
Preference (score)	Post	4.0938	0.5880	0.5000	4.209 **	−3.358 [b] **
	Pre	3.5938	0.6148		(0.000)	(0.001)
Willingness to participate (score)	Post	3.4375	0.5644	0.5313	4.477 **	−3.494 [b] **
	Pre	2.9063	0.7344		(0.000)	(0.000)
Balance beam (sec)	Post	20.2156	3.8553	−2.0425	−8.180 **	−4.899 [c] **
	Pre	22.2581	4.1979		(0.000)	(0.000)
10-m-turnback run (sec)	Post	9.4419	1.0347	−1.5788	−8.068 **	−4.937 [c] **
	Pre	11.0206	1.4957		(0.000)	(0.000)
Standing long jump (cm)	Post	89.8159	14.9470	5.9250	10.012 **	−4.937 [b] **
	Pre	83.8909	15.7606		(0.000)	(0.000)

Note: * $p < 0.05$; ** $p < 0.01$; [b] based on negative rank; [c] based on positive rank.

Table 4 compares the difference between the post-measured values and the pre-measured values of the measuring index in the control group. This is mainly to infer whether the research H4 is true; that is, that the post-measured value of the measuring index among children in the control group after implementing physical activity training would be significantly better than the pre-measured value. Table 4 shows that the average difference (post-measured minus pre-measured value) in attention, preference, and willingness to participate were 0.1250 (p-value in t-test = 0.379 > 0.05; p-value in Wilcoxon's statistics z-test = 0.378 > 0.05), 0.0938 (p-value in t-test = 0.184 > 0.05; p-value in Wilcoxon's statistics z-test = 0.180 > 0.05), and 0.0937 (p-value in t-test = 0.374 > 0.05; p-value in Wilcoxon's statistics z-test = 0.366 > 0.05), respectively. This reveals that children in the control group were not able to significantly enhance their attention, preference, and willingness to participate after implementing the traditional physical courses. Therefore, the research H4 was not true. In addition, the average difference in balance beam, 10-m turnback run, and standing long jump were −0.3625 (p-value in t-test = 0.016 < 0.05; p-value in Wilcoxon's statistics z-test = 0.025 < 0.05), −0.1841 (p-value in t-test = 0.008 < 0.01; p-value in Wilcoxon's statistics z-test = 0.002 < 0.01), and 0.7956 (p-value in t-test = 0.004 < 0.01; p-value in Wilcoxon's statistics z-test = 0.010 < 0.05), respectively. This shows that the control group children significantly enhanced their motor skills in dynamic balance, hopping, and jumping after being given traditional physical courses. The three measuring indices' testing results supported the idea that post-measured value of the measuring index for motor skills would be better than the result of the pre-measured value among the children in the control group after traditional physical courses. Therefore, H4 was supported. Last, it was found that traditional physical courses enhanced the children's motor skills but failed to develop and effectively enhance their learning attention, preference, and willingness to participate through teaching interaction.

Table 4. Comparison of the post- to pre-measurement value on the control group (Obs. = 32).

Measuring Index	Measurement Period	Basic Statistics		Paired Difference Test (Post-to-Pre)		Kruskal–Wallis Test
		Mean	S.D.	Average Difference	t-test (p-Value)	z-Test (p-Value)
Attention (score)	Post	6.5938	2.9497	0.1250	0.892	−0.881 [b]
	Pre	6.4688	3.0159		(0.379)	(0.378)
Preference (score)	Post	3.5625	0.6189	0.0938	1.359	−1.342 [b]
	Pre	3.4688	0.6713		(0.184)	(0.180)
Willingness to participate (score)	Post	2.9688	0.7822	0.0937	0.902	−0.905 [b]
	Pre	2.8750	0.7513		(0.374)	(0.366)
Balance beam (sec)	Post	21.7947	3.6642	−0.3625	−2.543 *	−2.244 [c] *
	Pre	22.1572	3.8285		(0.016)	(0.025)
10-m-turnback run (sec)	Post	10.8638	1.3092	−0.1841	−2.859 **	−3.136 [c] **
	Pre	11.0478	1.4029		(0.008)	(0.002)
Standing long jump (cm)	Post	85.8356	13.3531	0.7956	3.130 **	−2.581 [b] *
	Pre	85.0400	13.7385		(0.004)	(0.010)

Note: * $p < 0.05$; ** $p < 0.01$; [b] based on negative rank; [c] based on positive rank.

Table 5 examines whether the average rate of change in measuring index after implementing physical courses among children in the experimental group was significantly better than that in the control group. That is, testing whether children who were given innovative physical courses would be able to achieve a substantially better effect in the enhancement of their motor skills compared to those who were given traditional physical courses, in order to test the veracity of research H5. The results in Table 5 reveal that the average change in the experimental group in terms of attention, preference, and willingness to participate after the implementation of physical activity training were higher than 0.9375 (p-value in t-test = 0.000 < 0.01; p-value in Mann-Whitney test = 0.000 <0.01), 0.4063 (p-value in t-test = 0.005 < 0.01; p-value in Mann-Whitney test = 0.006 < 0.01), and 0.4375 (p-value in t-test = 0.007 < 0.01; p-value in Mann-Whitney test = 0.006 < 0.01), respectively, compared to the data in the control group. Their results demonstrate that the children in the experimental group enhanced their learning mentalities of attention, preference, and willingness to participate after implementing innovative physical courses significantly better than children in the control group. In terms of the average change in balance beam, 10-m turnback run and standing long jump, the experimental group achieved −1.6800 (p-value in t-test = 0.000 < 0.01; p-value in Mann-Whitney z-test = 0.000 < 0.01), −1.3947 (p-value in t-test = 0.000 < 0.01; p-value in Mann-Whitney z-test = 0.000 < 0.01), and 5.1294 (p-value in t-test = 0.000 < 0.01; p-value in Mann-Whitney z-test = 0.000 < 0.01), respectively, compared to the control group. This reveals that the average effect of enhancement in dynamic balance, hopping, and jumping among children in the experimental group after implementing innovative physical courses was significantly better than those in the control group. Finally, the six measuring indices' testing results found that the children in the experimental group achieved a significantly better average measuring index after implementing the course than the control group. This means that research H5 is accurate and proves that the innovative course, intergrating music and image technology into physical training, achieved a significantly improved effect in enhancing children's motor skills than traditional physical training.

Table 5. Comparison of the learning effects for experimental vs. control group based on the average difference for post- to pre-measurement value (Obs. = 64).

Measuring Index	Average Difference		Levene's Test on Variance		*t*-test on Mean	Mann–Whitney Test
	Mean	S.D.	Hypothetical Variance	F-Test (*p*-Value)	*t*-test (*p*-Value)	z-Test (*p*-Value)
Attention (score)	0.9375	0.2091	Equal #	0.475	4.483 **	−3.953 **
			Unequal	(0.493)	(0.000)	(0.000)
Preference (score)	0.4063	0.1374	Equal	23.080 **	2.957 **	−2.724 **
			Unequal #	(0.000)	(0.005)	(0.006)
Willingness to participate (score)	0.4375	0.1578	Equal	6.676 *	2.773 **	−2.744 **
			Unequal #	(0.012)	(0.007)	(0.006)
Balance beam (sec)	−1.6800	0.2875	Equal #	2.855	−5.843 **	−5.096 **
			Unequal	(0.096)	(0.000)	(0.000)
10-m-turnback run (sec)	−1.3947	0.2060	Equal	15.494 **	−6.771 **	−6.324 **
			Unequal #	(0.000)	(0.000)	(0.000)
Standing long jump (cm)	5.1294	0.6441	Equal	11.548 **	7.964 **	−6.453 **
			Unequal #	(0.001)	(0.000)	(0.000)

Note: * $p < 0.05$; ** $p < 0.01$; # represent the accepted assumption.

4. Discussions

According to Goodway and Branta (2003) [17] and Bai et al. (2020) [18], appropriate interventions and improvement strategies for motor skills could improve motor skills for preschool children. At the same time, based on Jones et al. (2019)'s study of physical activity interventions for children aged 3 to 5 years, it is recommended that curriculum elements are taken into account and creative and unique educational approaches are developed. Wang (2004) [20] supports adopting innovative sports programs that are much better for preschoolers in improving their athletic skills than a general sports program. In addition, Derri et al. (2001) [25] recommended developing training courses related to integrating music and physical activities, particularly for preschool physical education courses [27].

This study was supervised by a team comprising experts for senior childhood education. It developed a set of courses that integrated technology, music, and images into children's physical activities after observing the physical courses at preschools in Taiwan for a lengthy time. Nevertheless, the combination of melodies and images made for an innovative physical course with a teaching curriculum jointly developed by technology music designers, physical fitness training teachers, and experts for childhood education. Music designers used technology equipment to create assisting music suitable for children's physical activities to increase children's sensation and attention during the operation of the teaching of original physical activities.

The results of this study found that children's motor skills in dynamic balance, hopping, and jumping improved significantly, whether using traditional or innovative physical education courses. A more important result was that children who took innovative physical education courses improved their motor skills in dynamic balance, hopping, and jumping significantly more so than via traditional methods. These results show that the curriculum has a significant impact on children's learning outcomes. Comparatively, Early et al. (2006) [14] focused on early childhood education using mathematical skills to conduct research and found little correlation between curriculum or other factors (teachers' education, professionalism, certification, curriculum quality) and children's learning outcomes. This view differs from the results of this study, which is in support of the relation between course and learning outcomes. The reason for the difference may be due to differences between mathematical and physical skills. In addition, this study involved interdisciplinary interventions that used music interventions to improve brain network and sensory (visual or auditory) and motor (calf, arm, or joint) development [29], thus improving learning outcomes.

The results of this study's intervention in the physical activity of young children using scientific and technological music, and the intervention to support physical activity with music, shows that these can have significant positive effects [21,23], in terms of speed, accuracy, and stability [23]. This is also supported by Derri et al. (2001) [25], who claimed that integrating music into sports activities for children's education has a significant positive impact in improving motor skills, such as galloping, leaping, horizontal jumping, and skipping..

In addition, this study validated the strategy of curriculum adjustment for physical activities at preschools in Taiwan, achieving a significantly better and more positive impact on the learning and attitudes towards physical activities among children; especially noted were the significant positive effects in children's attention, preference, and willingness to participate when carrying out the innovative course combining music and image technology with physical activity. On the other hand, there were no significant changes for the control group compared to the children in the traditional physical courses. These results show that innovative fitness methods can increase children's engagement and willingness to participate in sports activities in the psychological analysis of sports. When music is combined with physical activity, it will benefit children's learning psychology when they engage in physical activity. The results of this study show that past studies have been less analytical and well-discussed.

Based on the above, this study suggests that the innovative curriculum of applying music technology to sports activities can significantly improve children's motor skills and their attention and preference. This result is consistent with Mulyono et al. (2020) [8], whose support for enhancing students' satisfaction and ability is essential in further strengthening the school's reputation and development.

5. Conclusions

This study put an innovative teaching experiment program into practice that combined music technology into the physical activity curriculum for children. The experimental results showed that preschoolers had significantly better training results (e.g., willingness to participate, balance beam, 10-m turnback run, and standing long jump) and learning mentality (e.g., attention and preference) in the innovative physical activity curriculum. The results showed that innovative physical activity significantly improved children's attention and preference in learning and was substantially better than traditional physical activity in enhancing sports skills. However, there is no further understanding of the causal relationship between attention (preference) and motor skills in children's innovative physical activity, which is the direction for further follow-up research. A comprehensive education that integrates science, technology, engineering, art, and mathematics, called STEAM education, has gradually become mainstream [30]. Meanwhile, facing the superiority of modern technology, many education experts have emphasized cross-curricular integrated education (CCIE). These directions will be the focus of the development of the curriculum in early childhood education. Based on the experience of this study, it is suggested that the future direction of curriculum development in preschools should combine the thinking approaches of technology and cross-curricular fields for curriculum adjustment to effectively enhance preschool children's interest and capability to engage with course activities. This should be a particular area of interest for incorporating into professional teacher preparation programs.

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