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A study on the influence mechanism of playful dance rhythm on the quality of peer interactions in young children under the perspective of social-emotional competence and educational intervention countermeasures

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SUMMARY: *In this study, 630 school students from two kindergartens in W city were selected as the research object by questionnaire survey method, and the questionnaire of "Questionnaire on the Level of Early Childhood Playful Dance Rhythm", "Questionnaire on Social-Emotional Competence" and "Questionnaire on the Quality of Early Childhood Peer Interaction" were used to conduct the actual measurement of questionnaires to the teachers of the early childhood children. Correlation analysis and multiple linear regression were used to investigate the effects of young children's gamified dance rhythm on the quality of peer interactions and to test the influence mechanism of social-emotional competence. Young children's peer interaction quality, gamified dance rhythm level and socio-emotional competence level were all in the middle-upper level, and multiple dimensions of peer interaction quality of gamified dance rhythm level showed significant positive correlation, among which rhythm and coordination type could significantly predict verbal and non-verbal interaction skills. Parent-child relationship and socio-emotional competence mediated the different dimensions of children's playful dance movement levels, and the mediation effect was significant. Parent-child relationship and social-emotional competence also acted as chain mediators of different dimensions of young children's level of playful dance rhythm with young children's quality of peer interactions. Accordingly, this study proposes an educational intervention response that integrates skill training and emotional education, which points out the direction of social development education for young children.*

KEYWORDS: *peer interaction quality; social-emotional competence; young children's playful dance rhythm; multiple linear regression method; mediation effect*

1 Introduction

Early childhood is an important period in the development of individual human beings, and the cultivation of social-emotional competence is of great significance in improving the quality of peer interactions during this period [1, 2]. Especially with the increasing opportunities for young children to have contact with their peers, the ability to interact with peers has gradually become a crucial part of their growth process, and social-emotional competence is one of the

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important factors in the process of interacting with peers [3-6]. As a special form of game, gamified dance rhythm organically combines various comprehensive abilities including visual, auditory, tactile and other senses of young children through the way of teaching and learning in a fun way, which plays an important role in improving the quality of peer interactions under the perspective of social-emotional ability [7-10].

For young children, emotional competence is like their secret weapon in the big arena of interpersonal interactions [11]. It is not only knowing that they are happy or sad, but more importantly, being able to understand why they feel such emotions and how to deal with them in an appropriate way, and also being able to keenly notice the emotional changes of the little ones around them and respond appropriately [12-15]. Playful dance rhythms, a performing art that presents itself in public, helps to develop this ability [16]. First of all, children's self-confidence is enhanced by displaying their performing talents through gamified dance rhythm, and at the same time, gamified dance rhythm is also a way of emotional expression, through body movements and facial expressions, children are able to better express their own feelings and wishes, so as to achieve the cultivation of emotional competence, and enhance the quality of their interactions with their peers [17-20].

In the process of young children's gamification of dance rhythms, certain educational intervention countermeasures are also needed [21]. First of all, some simple and clear movements can be selected and combined with appropriate music for young children to imitate and follow. In the process of playing, young children can be guided to make some simple dance creations at the right time to stimulate their creativity and desire for expression [22-24]. In addition, dance games can also be carried out through group cooperation, so that young children can cultivate their sense of cooperation and team spirit in the process of dancing with other little friends [25, 26].

The study designed questionnaire scales for the variables of social-emotional competence, young children's playful dance rhythms and quality of peer interactions respectively, and constructed multiple regression models and chain mediation models to quantitatively analyze the complex relationships among the variables. First, descriptive statistics and demographic difference tests were conducted for each core variable, and the correlations between variables were initially explored through Pearson correlation analysis. Then, quantitative analysis was conducted through multiple regression models to reveal the intrinsic path of action of gamified dance rhythm, an art education activity, in enhancing the quality of peer interactions. Finally, the chain mediation model was used to examine the mediating roles played by social-emotional competence and parent-child relationship in this mechanism of influence, providing precise empirical data for effective educational intervention programs.

2 Study design

2.1 Research hypothesis

This study proposes the following hypotheses based on existing research and relevant theories:

Hypothesis 1: There is a difference between the quality of peer interactions of early childhood students and the level of playful dance rhythm of young children in terms of demographic variables (gender, grade, place of birth, whether they are alone or not, and the integrity of their families).

Hypothesis 2: There is a correlation between the level of playful dance rhythms, the level of socio-emotional competence, and peer interactions of young children.

Hypothesis 3: The level of socio-emotional competence mediates the relationship between toddlers' level of playful dance movement and peer interactions.

2.2 Study population

In this study, the method of questionnaire survey was used to randomly select 15 classes as the sampling objects for the school students of a two kindergartens in W city, totaling 630 students. A total of 630 questionnaires were distributed, 30 invalid questionnaires were excluded, and finally 600 valid questionnaires were obtained, with a validity rate of 95.24%.

2.3 Research tools

The questionnaire of this study consists of four parts, namely: basic information, questionnaire on the level of play-based dance rhythm, questionnaire on social-emotional competence, and questionnaire on the quality of peer interactions. In this paper, based on previous studies, the questionnaire on the level of playful dance movement of young children was selected from the "Questionnaire on the Level of Playful Dance Movement of Young Children", the questionnaire on social-emotional competence was selected from the "Questionnaire on Social Emotional Competence", and the questionnaire on the quality of peer interactions was selected from "Questionnaire on the Quality of Peer Interactions of Young Children", which was revised in 2006, which was used as a blueprint and revised appropriately to take into account the special characteristics of young children between the ages of 3-6. The above three questionnaires were used as the blueprints and revised appropriately in light of the special characteristics of 3-6-year-old children.

(1) Basic information

On the basis of the collation and analysis of existing literature, the demographic factors that may affect young children's playful dance rhythms, social-emotional competence, and quality of peer interactions were summarized to form the basic information section, and the basic information of young children includes: kindergarten in which the child is enrolled, name of the child, gender of the child, whether or not the child is an only child, date of birth, class in which he or she is enrolled, number of children in the family, ranking of the children, gender of the compatriots, and the compatriots' date of birth. The basic information of the family includes: family location, parents' education, etc.

(2) Questionnaire on the quality of young children's peer interactions

This study used the Questionnaire on the Quality of Peer Interaction of Young Children Aged 3-6. This questionnaire was formed through localized exploration on the basis of combining the questionnaires compiled by other scholars. In this study, the early childhood teachers in the class of the research subjects were randomly selected, distributed to them and recovered. The questionnaire consists of 20 questions, with items scored between 1 and 4, and is divided into four main dimensions: social initiative, verbal and non-verbal interaction skills, social barriers, and pro-social behavior. The "social impairment" sub-dimension is reverse scored, with a higher score indicating a lower level of social impairment in the child. The researcher adjusted the language expression of some questions according to the reality, and analyzed the reliability and validity of the Questionnaire on the Quality of Young Children's Peer Interaction. The overall Cronbach alpha coefficient of the questionnaire was 0.855, the reliability coefficients of the dimensions were kept in the range of 0.828-0.683, and the value of the KMO index was 0.875, which was greater than 0.6 and the Bartlett's test of sphericity showed a significant level of (1), (2), (3), (4), (5) and (6). Sphericity test showed a significant level ($p<0.001$), indicating that the questionnaire has good reliability and validity. The questionnaire should be revised appropriately to make it suitable for measuring the quality of peer interactions.

(3) Questionnaire on Playful Dance Movement Levels of Young Children

The Early Childhood Play-based Dance Rhythm Level Questionnaire is designed to

understand the children's dance rhythm ability in play-based situations. In this study, the children's play-based dance rhythm level was classified into four progressive types, namely, perception and imitation, rhythm and coordination, expression and creativity, and synthesis and performance, which represent the basic perception, initial coordination, active expression, and independent integration, respectively. The items were scored between 1-5, the overall Cronbach alpha coefficient of the questionnaire was 0.849, the reliability coefficients of the dimensions were kept between 0.828-0.689, the value of the KMO index was 0.886, which was greater than 0.6, and the Bartlett's test of sphericity presented a significant level ($p<0.001$), which indicated that the questionnaire had a good degree of reliability and validity. The questionnaire was appropriately revised to make it suitable for measuring the level of playful dance rhythm in young children.

(4) Social-emotional competence level questionnaire

This questionnaire was designed to assess the level of social and emotional competence development of children in kindergarten daily life and activities. The questionnaire consisted of 15 questions and was divided into three dimensions, which were emotional understanding, emotional expression, and empathy. The questionnaire was scored on a five-point scale. The overall Cronbach alpha coefficient of the questionnaire was 0.864, the reliability coefficients of the dimensions remained between 0.828-0.689, the KMO index value was 0.898, which was greater than 0.6, and the Bartlett's test of sphericity presented a significant level ($p<0.001$), which indicated that the questionnaire had a good reliability and validity.

2.4 Implementation process

The questionnaires were collected through both questionnaire star and distribution of paper copies. Early childhood teachers in schools were contacted, distributed to and collected from them.

2.5 Statistical analysis of data

The data obtained in this study were initially screened using excel, and descriptive statistics, t-test, ANOVA, correlation analysis between two and two variables, and stepwise regression analysis to construct structural equations to test for mediating effects were performed using spss22.

Multiple linear regression is a widely used calibration method, which is to set the dependent variable and multiple independent variables have a linear relationship, the dependent variable can again multiple independent variables for prediction and estimation. Assuming that there is no systematic error in the test, the observations are independent of each other, and the error obeys the normal distribution, based on the assumption that there are m independent variables, which are set to be $x_j(j=1,2,\cdots,m)$, and the dependent variable to be Y, and set there are a total of n samples, that is, $y_i(i=1,2,\cdots,n)$, and build a linear model between y and x:

$$y_i = b_0 + b_{i1}x_{i1} + b_{i2}x_{i2} + b_{i3}x_{i3} + \cdots + b_{im}x_{im} + e \quad (1)$$

In the above equation, $b_j(j=0,1,2,\cdots,m)$ are the regression coefficients, and all n samples are now expressed in the following form:

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} = \begin{bmatrix} 1 & x_{11} & x_{12} & \cdots & x_{1m} \\ 1 & x_{21} & x_{22} & \cdots & x_{2m} \\ 1 & \vdots & \vdots & \ddots & \vdots \\ 1 & x_{n1} & x_{n2} & \cdots & X_{nm} \end{bmatrix} \begin{bmatrix} b_0 \\ b_1 \\ \vdots \\ b_m \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \\ \vdots \\ e_n \end{bmatrix} \tag{2}$$

$$Y = XB + E \tag{3}$$

The core of the multiple regression model is to find the regression coefficients, and the central idea of the method is to minimize the sum of squares of the errors. By taking the partial derivatives of the regression coefficients, using the least squares method, and utilizing the derivatives of the matrix function, we can derive the expression for the solution of the regression coefficients as follows:

$$B = \left(X^T X \right)^{-1} X^T Y \tag{4}$$

Although multivariate linear regression is widely used, and the method has good performance for some purely linear systems, but there are some disadvantages, that is, if there is correlation between the independent variables, and there is noise interference and so on, the usefulness of the model is obviously reduced, in order to overcome the systematic error caused by covariance, we have improved the method by using the principal component regression.

The mediator variable is the pivot of the relationship between two variables, that is to say, the change of the independent variable X causes the change of the mediator variable M, and the change of the mediator variable M causes the change of the dependent variable Y. In this study, family socioeconomic status is the independent variable, self-esteem is the mediating variable, and peer acceptance and peer fear of low self-esteem are the dependent variables. After centering all the variables, the following equation and path diagram can be used to describe the relationship between the variables, and Figure 1 shows the standard mediating variable model.

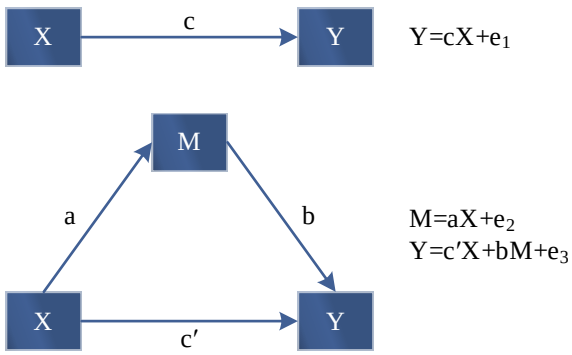

Figure 1: Model of Standard and Intermediate Variables

The coefficient c in Figure 1 is the total effect, i.e., the direct effect of X on Y. The coefficients a and b are the mediating effect, also called the indirect effect, i.e., the indirect effect through M. The coefficient c′ is the direct effect after taking into account the mediating effect, i.e., the influence of the direct effect based on the existence of the mediating effect.

3 Findings

3.1 Descriptive statistics and tests for demographic differences

3.1.1 Descriptive statistics and demographic differences in the quality of peer interactions

The items of the Quality of Peer Interaction Questionnaire for Young Children were scored between 1 and 4, and the theoretical mean of the scale items was 2.5, with a score higher than 2.5 considered to be a good quality of peer interaction for young children. Table 1 shows the results of descriptive statistics of the quality of peer interactions of young children.

The overall mean of the quality of peer interactions of young children was 3.03, with a standard deviation of 0.34, and the means of the dimensions ranged from 2.74 to 3.17, with verbal and nonverbal skills scoring the highest at 3.17, and social initiative scoring the lowest at 2.74. The overall mean of the quality of young children's peer interactions and the means of the dimensions were higher than the theoretical mean and significantly different ($p<0.001$), indicating that the quality of peer interactions of the study participants was better than that of the theoretical mean. , indicating that the quality of peer interactions of the study participants was at a moderate to high level.

Table 1: Descriptive statistical results of child peer communication quality

Name	Sample size	Minimum value	Maximum value	Mean	Standard deviation	Compared to the theory mean
Social initiative	600	1.56	4	2.74	0.42	11.944***
Pro-social behavior	600	1.51	4	3.13	0.44	33.267***
Language and nonverbal ability	600	1.33	4	3.17	0.42	33.944***
Social barrier	600	1.12	4	3.16	0.52	26.251***
Quality of peer communication	600	2.12	4	3.03	0.34	36.488***

To further explore the differences in the quality of young children's peer interactions across demographic variables, the resulting data were subjected to independent samples t-test and ANOVA tests. The results of the independent samples t-test and ANOVA test are shown in Table 2. There were no significant differences ($p>0.05$) in the total score of the quality of young children's peer interactions and its dimensions in terms of father's literacy, gender of the child, age class, and whether or not the child was an only child. There was a significant difference in the quality of young children's peer interactions only in the dimension of social impairment in terms of father's age.

Table 2: Independent sample t test and variance analysis test results

		Quality of peer communication	Social initiative	Pro-social behavior	Language and nonverbal communication skills	Social barrier
Father's age	<30	3.02±0.35	2.86±0.53	3.08±0.45	3.18±0.52	2.99±0.74
	31-35	3.05±0.32	2.72±0.45	3.11±0.34	3.18±0.42	3.22±0.52
	36-40	3.02±0.33	2.73±0.42	3.14±0.46	3.16±0.48	3.14±0.45
	>41	3.05±0.34	2.75±0.50	3.18±0.43	3.22±0.45	3.13±0.53
	F	0.332	0.884	1.935	0.395	4.045**
Cultural degree	Junior middle school and below	2.97±0.25	2.63±0.33	3.07±0.31	3.15±0.35	3.06±0.54
	High school and secondary and secondary	3.05±0.32	2.73±0.52	3.14±0.38	3.24±0.42	3.10±0.65
	Higher vocational college	3.04±0.32	2.76±0.47	3.12±0.43	3.14±0.48	3.16±0.59
	Undergraduate	3.05±0.32	2.79±0.46	3.15±0.45	3.21±0.44	3.20±0.46
	Graduate student	2.99±0.33	2.66±0.42	3.02±0.33	3.15±0.45	3.08±0.54
	F	1.544	1.253	1.325	0.852	0.915
Gender	Man	3.05±0.32	2.77±0.45	3.15±0.45	3.18±0.45	3.15±0.54
	Female	3.04±0.36	2.73±0.47	3.10±0.41	3.19±0.43	3.16±0.54
	T	0.532	0.927	1.263	-0.174	-0.313
	Sig	0.592	0.355	0.206	0.862	0.755
Age class	Middle class	3.04±0.32	2.74±0.44	3.10±0.42	3.18±0.45	3.18±0.58
	Big class	3.05±0.32	2.74±0.45	3.14±0.42	3.18±0.44	3.12±0.54
	T	-0.078	-0.092	-1.091	-0.198	0.868
	Sig	0.935	0.927	0.275	0.842	0.385
Is it only	Only	3.06±0.35	2.77±0.45	3.12±0.45	3.22±0.46	3.15±0.58
	No only	3.03±0.32	2.72±0.44	3.13±0.42	3.15±0.42	3.14±0.52
	T	0.754	1.022	-0.645	1.397	0.325
	Sig	0.453	0.305	0.519	0.162	0.746

3.1.2 Descriptive statistics and demographic differences in gamified dance rhythms

Table 3 shows the results of descriptive statistics of children's playful dance movement level, the overall mean score of children's playful dance movement level is 3.25±0.44. It can be observed that the overall level of children's playful dance movement level and the scores of the dimensions of perception and imitation, rhythm and coordination, synthesis and performance are higher than the theoretical mean and there is a significant difference ($p<0.001$), the scores of the dimensions of expression and creativity are lower than the theoretical mean and there is a significant difference ($p<0.001$). significant difference ($p<0.001$), indicating that the overall level of playful dance rhythm and the scores of the dimensions of Perception and Imitation, Rhythm and Coordination, Integration and Expression of the young children in the study population are at the upper middle level, and the scores of Expression and Creation are at the lower middle level.

The results of the independent samples t-test and ANOVA test of the data are shown in Table 4, which shows that there is no significant difference in the total score of the level of playful

dance rhythm in young children on all demographic variables (p>0.05).

There was a significant difference between Perception and Imitation type on father's age (P<0.05). Expressive and creative types were significantly different (P<0.05) in terms of father's age, literacy level and toddler's gender.

Table 3: Descriptive statistical results of the rhythm of the child's game

Name	Sample size	Minimum value	Maximum value	Mean	Standard deviation	Compared to the theory mean
Perception and imitation	600	1.64	5	3.74	0.59	31.896***
Rhythm and coordination	600	1.32	5	3.27	0.64	9.604***
Expression and creation	600	1.31	5	3.28	0.95	-15.451***
Integrated and phenotype	600	1.02	5	3.36	0.82	10.241***
The rhythm of the child's game	600	2.07	5	3.25	0.44	10.454***

Table 4: Independent sample t test and variance analysis test results of data

		The rhythm of the child's game	Perception and imitation	Rhythm and coordination	Expression and creation	Integrated and phenotype
Father's age	<30	3.25±0.52	3.58±0.63	3.35±0.41	2.74±0.52	3.45±0.76
	31-35	3.22±0.48	3.88±0.48	3.28±0.36	2.19±0.42	3.42±0.55
	36-40	3.21±0.36	3.94±0.48	3.24±0.45	2.18±0.48	3.33±0.85
	>41	3.21±0.54	3.8±0.54	3.22±0.48	2.15±0.45	3.26±0.85
	F	0.725	7.256***	0.196	8.545***	1.061
Cultural degree	Junior middle school and below	3.26±0.55	3.74±0.36	3.25±0.36	2.74±0.75	3.25±0.74
	High school and secondary and secondary	3.37±0.32	3.73±0.52	3.35±0.38	3.55±0.41	3.42±0.65
	Higher vocational college	3.35±0.32	3.96±0.47	3.17±0.43	3.25±0.44	3.32±0.59
	Undergraduate	3.26±0.32	3.79±0.46	3.36±0.45	3.16±0.42	3.45±0.46
	Graduate student	3.18±0.33	3.76±0.42	3.25±0.33	3.24±0.42	3.26±0.54
	F	1.806	1.435	1.505	3.884***	1.195
Gender	Man	3.18±0.32	3.86±0.45	3.25±0.44	2.18±0.45	3.36±0.54
	Female	3.24±0.36	3.82±0.47	3.35±0.42	2.39±0.43	3.39±0.54
	T	-1.745	0.395	-1.945	-2.274*	-0.375
	Sig	0.082	0.694	0.055	0.025	0.705
Age class	Middle class	3.24±0.32	3.85±0.42	3.29±0.45	3.27±0.42	3.36±0.56
	Big class	3.25±0.32	3.87±0.41	3.29±0.46	3.29±0.47	3.41±0.51
	T	-0.405	-0.102	-0.023	-0.325	-0.562
	Sig	0.688	0.924	0.985	0.749	0.577
Is it only	Only	3.26±0.45	3.87±0.44	3.12±0.45	2.32±0.41	3.38±0.88
	No only	3.23±0.45	3.84±0.49	3.13±0.42	2.26±0.46	3.34±0.82
	T	0.724	0.166	0.411	0.855	0.305
	Sig	0.478	0.872	0.685	0.399	0.762

3.1.3 Descriptive statistics and demographic differences in social-emotional competence

The items of the Behavioral Questionnaire on Social Emotional Competence Level of Young Children are scored between 1 and 5, and a score higher than 3 is considered to be a good level of social emotional competence. In order to examine the level of social emotional competence, the minimum, maximum, mean, and standard deviation of the overall level of social emotional competence level and the scores of the different dimensions of emotional comprehension, expression of emotions, and empathy were counted separately.

Table 5 shows the results of descriptive statistics of social-emotional competence level, the overall mean score of social-emotional competence level is 3.65, the standard deviation is 0.60, the mean of each dimension is between 3.33 and 3.84, the overall mean score of social-emotional competence level and the mean score of each dimension are higher than the theoretical mean value and there is a significant difference ($p<0.001$), which indicates that the social-emotional competence level of the research participants scores are in the upper middle level.

Independent samples t-test and ANOVA test were performed on the data. The results of the tests are shown in Table 6, the level of social-emotional competence and its dimensions do not differ significantly in the age of the father and the age class the toddler is in ($p>0.05$), the level of social-emotional competence only the empathy dimension has a significant difference in the father's literacy ($p<0.05$), and the toddlers whose fathers' literacy is bachelor's degree have significantly higher scores on empathy than those whose fathers' literacy is high school and college toddlers' scores. There was a significant difference ($p<0.05$) in the level of social-emotional competence only emotion comprehension dimension in terms of the gender of the toddlers. There was a significant difference ($p<0.05$) in the level of social-emotional competence only emotion expression dimension on whether or not the toddler was born alone, with the scores on emotion expression being higher for the toddlers born alone than the scores for the toddlers who were not born alone.

Table 5: Descriptive statistical results of social emotional competence levels

Name	Sample size	Minimum value	Maximum value	Mean	Standard deviation	Compared to the theory mean
Emotional understanding	600	1.74	5	3.65	0.61	23.196***
Emotional expression	600	1.22	5	3.33	0.674	11.125***
Empathy	600	1.81	5	3.84	0.72	-25.712***
Level of social emotion	600	1.89	5	3.65	0.60	23.588***

Table 6: Independent sample t test and variance analysis test results of data

		Level of social emotion	Emotional understanding	Emotional expression	Empathy
Father's age	<30	3.72±0.55	3.73±0.55	3.48±0.72	3.84±0.72
	31-35	3.61±0.59	3.64±0.65	3.36±0.72	3.76±0.65
	36-40	3.57±0.56	3.62±0.63	3.25±0.70	3.82±0.71
	>41	3.65±0.62	3.71±0.60	3.45±0.83	3.82±0.82
	F	0.994	0.952	1.925	0.251
Cultural degree	Junior middle school and below	3.47±0.53	3.52±0.60	3.21±0.72	3.63±0.74
	High school and secondary and secondary	3.77±0.64	3.75±0.65	3.43±0.82	3.84±0.75
	Higher vocational college	3.58±0.55	3.61±0.66	3.32±0.75	3.67±0.72
	Undergraduate	3.68±0.58	3.72±0.63	3.42±0.74	3.93±0.65
	Graduate student	3.51±0.55	3.48±0.56	3.32±0.69	3.77±0.74
	F	2.17	2.24	0.764	2.675*
Gender	Man	3.57±0.58	3.58±0.66	3.32±0.75	3.76±0.65
	Female	3.68±0.59	3.74±0.55	3.43±0.74	3.81±0.74
	T	-1.932	-2.517*	-1.211	-1.026
	Sig	0.055	0.013	0.225	0.305
Age class	Middle class	3.61±0.65	3.65±0.65	3.36±0.74	3.77±0.66
	Big class	3.63±0.57	3.64±0.65	3.38±0.73	3.84±0.55
	T	-0.326	-0.145	-0.266	-0.469
	Sig	0.741	0.882	0.79	0.646
Is it only	Only	3.65±0.56	3.61±0.58	3.44±0.71	3.85±0.70
	No only	3.58±0.69	3.62±0.62	3.31±0.75	3.78±0.75
	T	1.503	1.128	2.043*	0.891
	Sig	0.135	0.262	0.043	0.375

3.2 Correlation analysis between playful dance rhythm and quality of peer interactions in young children

In this study, Pearson's correlation analysis was conducted between young children's level of playful dance rhythm measured by the Young Children's Playful Dance Rhythm Level Questionnaire and the quality of young children's peer interactions between the ages of 3 and 6. The results of the correlation analysis are shown in Table 7. Note: $p < 0.05$*, $p < 0.01$**, $p < 0.001$***.

Perceptual and imitative types in playful dance rhythms were significantly and positively correlated with social initiative ($r=0.175$, $p<0.001$), verbal and nonverbal interaction skills ($r=0.202$, $p<0.001$), pro-social behaviors ($r=0.167$, $p<0.01$), and significantly and negatively correlated with social impairment ($r=- 0.132$, $p<0.01$). This suggests that the better the toddlers' perception and imitation of playful dance rhythms, the better the quality of the toddlers' peer interactions.

The rhythmic and coordinative dimensions were significantly and positively correlated with toddlers' social initiative ($r=0.142$, $p<0.01$), verbal and non-verbal interaction skills ($r=0.188$,

p<0.001), pro-social behaviors (r=0.122, p<0.01), and significantly and negatively correlated with social deficits (r=-0.137, p< 0.01). It indicates that the higher the level of rhythm and coordination in the toddlers' playful dance rhythms, the better the toddlers' peer interaction quality dimensions developed.

The expressive and creative dimensions were significantly and positively correlated with toddlers' verbal and nonverbal interaction skills (r=0.137, p<0.01) and with pro-social behavior (r=0.138, p<0.01). The results of this study indicate that the higher the level of expression and creativity of young children, the better the development of verbal and non-verbal interaction skills and pro-social behavior of young children.

Table 7: Relevant analysis results

	Social initiative	Language and nonverbal communication skills	Pro-social behavior	Social barrier
Perception and imitation	0.175**	0.202***	0.167**	-0.132**
Rhythm and coordination	0.142**	0.188***	0.122**	-0.137**
Expression and creation	0.086	0.137**	0.138**	-0.055
Integrated and phenotype	0.037	0.065	0.058	-0.011

3.3 Regression Analysis of Playful Dance Rhythms and Quality of Peer Interaction in Young Children

In this study, multiple linear regressions were conducted on the effects of young children's playful dance rhythms on young children's social initiative, verbal and nonverbal interaction skills, pro-social behaviors, and social barriers, respectively, and the regression sub-equations of young children's playful dance rhythms on social initiative and pro-social behaviors were invalid (p>0.05); therefore, only the effects of young children's playful dance rhythms on young children's verbal and non-verbal interaction skills, and social barriers will be discussed here. Regression analysis.

Table 8 shows the regression coefficients for the effects of playful dance movement on verbal and nonverbal communication skills. The multivariate correlation coefficient between children's playful dance rhythm and children's verbal and nonverbal communication skills was 0.317, and the coefficient of determination R^2 was 0.106, indicating that the four dimensions of children's playful dance rhythm (the predictor variables) explained a total of 10.6% of the variance in children's verbal and nonverbal communication skills. On the other hand, no significance level was reached for the Perception and Imitation, Expression and Creation, and Synthesis and Expression dimensions of young children's play-based dance rhythm, indicating that these three variables explained very little of the variation in young children's verbal and nonverbal interaction skills. The standardized regression coefficient for the Rhythm and Coordination dimension of young children's playful dance rhythms was 0.118 (p<0.05), indicating that Rhythm and Coordination positively predicted young children's verbal and nonverbal interaction skills.

Table 8: Regression coefficients on language and nonverbal communication skills

	B	Standard error	Beta	T	P
Constants	3.002	0.306		9.825	0
Perception and imitation	0.025	0.030	0.053	0.859	0.392
Rhythm and coordination	0.046	0.021	0.118	2.377*	0.019
Expression and creation	-0.025	0.021	-0.063	-1.197	0.235
Integrated and phenotype	0.011	0.025	-0.018	0.415	0.681
R=0.315	R^2=0.106	Adjusted R^2=0.082	F=4.798***		

Table 9 shows the regression coefficients of early childhood gamified dance rhythm on early childhood social impairment, from which the following results can be obtained: the multiple correlation coefficient between early childhood gamified dance rhythm and early childhood social impairment is 0.211, and the coefficient of determination R2 is 0.046, which indicates that the four dimensions of early childhood gamified dance rhythm (predictor variables) explain a total of 4.6% of the variance in early childhood social impairment. In contrast, no significance level was reached on the Perception and Imitation, Expression and Creation, and Synthesis and Expression dimensions of early childhood gamified dance rhythms, indicating that these three variables explained very little of the variance in early childhood social impairment.

Table 9: The return of the child's game to the social barrier of the child

	B	Standard error	Beta	T	P
Constants	3.118	0.366		8.625	0
Perception and imitation	0.035	0.033	0.062	0.968	0.335
Rhythm and coordination	0.056	0.026	0.108	2.185*	0.027
Expression and creation	-0.008	0.026	-0.023	-0.377	0.702
Integrated and phenotype	-0.025	0.030	-0.038	-0.766	0.441
R=0.211	R^2=0.046	Adjusted R^2=0.025	F=1.978*		

3.4 Chain mediation effects

This study used a mediated effects test to explore the quality of young children's peer interactions as the dependent variable, the dimensions of young children's playful dance rhythms as the independent variables, and parent-child relationships and social-emotional competence as the mediating variables.

3.4.1 Chain-mediated effects of perceptual and imitative gamified dance rhythms

The results of the chain mediation effect analysis of perception and imitation type of gamification dance rhythm are shown in Table 10, the total effect and indirect effect of perception and imitation type to the quality of young children's peer interactions are significant. The value of the direct effect from perception and imitation type to the quality of young children's peer interactions was 0.059, the value of the total mediating effect was the sum of the three paths, i.e., 0.198, and the value of the total effect was the sum of the value of the direct effect and the value of the total mediating effect, i.e., 0.257. The ratio of the mediating effect in the total effect was 77.04%, i.e., 77.04% of the effect from perception and imitation type to the quality of young children's peer interactions was through the multiple mediators of parent-child relationship and social-emotional competence. Among them, the mediating effect of perception and imitation to the quality of early childhood peer interactions through parent-child relationship was 0.097, accounting for 37.74% of the total effect; the mediating effect of perception and imitation to the quality of early childhood peer interactions through socio-emotional competence was 0.061, accounting for 23.74% of the total effect; the chained

mediating effect of perception and imitation to the quality of early childhood peer interactions through parent-child relationship and socio-emotional competence was 0.040, accounting for 15.56% of the total effect.

Table 10: The chain intermediary effect of perception and imitation game

	Effect value	Standard error	Confidence interval	
Total effect	0.257	0.041	0.183	0.350
Direct effect	0.059	0.039	-0.022	0.148
Indirect effect	0.198	0.032	0.140	0.257
Path 1: Perception and imitation→ Parent relationship→ Child peer quality	0.097	0.028	0.061	0.141
Path 2: Perception and impersonation→ Social emotional ability→ And child peer quality	0.061	0.021	0.034	0.111
Path 3: Perception and imitation→ Child's relationship→ Social emotion ability→ Child peer quality	0.040	0.009	0.021	0.063

3.4.2 Chain-mediated effects of rhythmic and coordinated gamified dance rhythms

The results of the chain mediated effect analysis of rhythm and coordination type of gamified dance rhythm are shown in Table 11, the total effect and indirect effect from rhythm and coordination type to the quality of young children's peer interactions are significant. The value of the direct effect from rhythm and coordination to the quality of young children's peer interactions was 0.032, the value of the total mediating effect was the sum of the three paths, i.e., 0.213, and the value of the total effect was the sum of the direct effect value and the value of the total mediating effect, i.e., 0.245. The ratio of the mediating effect to the total effect was 86.94%, i.e., 86.94% of the effect of the rhythm and coordination type to the quality of young children's peer interactions was mediated through the multiple mediators of parent-child relationship and social-emotional competence. The mediating effect of rhythm and coordination on the quality of young children's peer interactions through parent-child relationship was 0.092, which accounted for 37.55% of the total effect; the mediating effect of rhythm and coordination on the quality of young children's peer interactions through socio-emotional competence was 0.092, which accounted for 37.55% of the total effect; and the chain mediating effect of rhythm and coordination on the quality of young children's peer interactions through parent-child relationship and socio-emotional competence was 0.029, accounting for 11.84% of the total effect.

Table 11: The chain mediation effect of rhythm and coordinated game

	Effect value	Standard error	Confidence interval	
Total effect	0.245	0.041	0.172	0.321
Direct effect	0.032	0.040	-0.055	0.112
Indirect effect	0.213	0.032	0.148	0.287
Path 1: Rhythm and coordination→ Parent relationship→ Xhild peer quality	0.092	0.021	0.061	0.135
Path 2: Rhythm and coordination→ Social emotional ability→ And child peer quality	0.092	0.022	0.034	0.142
Path 3: Rhythm and coordination→ Child's relationship→ Social emotion ability→ Child peer quality	0.029	0.010	0.021	0.055

3.4.3 Chain-mediated effects of expressive and creative gamified dance rhythms

The results of the chain mediated effect analysis of Expressive and Creative Playful Dance Rhythms are shown in Table 12, and the total and indirect effects from Expressive and Creative to Quality of Young Children's Peer Interaction are significant. The value of the direct effect from Expressive and Creative to the quality of young children's peer interactions was 0.050, the value of the total mediating effect was the sum of the three paths, i.e., 0.240, and the value of the total effect was the sum of the value of the direct effect and the value of the total mediating effect, i.e., 0.290. The ratio of the mediating effect to the total effect was 82.76%, i.e., 82.76% of the effect of the Expressive and Creative to the quality of young children's peer interactions was mediated through the multiple mediators of parent-child relationship and social-emotional competence. The mediating effect of the expressive and creative type on the quality of young children's peer interactions through parent-child relationship was 0.110, which accounted for 37.93% of the total effect; the mediating effect of the expressive and creative type on the quality of young children's peer interactions through socio-emotional competence was 0.090, which accounted for 31.03% of the total effect; and the chain mediating effect of the expressive and creative type on the quality of young children's peer interactions through parent-child relationship and socio-emotional competence was 0.040, accounting for 13.79% of the total effect.

Table 12: The chain intermediary effect of expression and creative dance rhythm

	Effect value	Standard error	Confidence interval	
Total effect	0.290	0.040	0.210	0.371
Direct effect	0.050	0.038	-0.030	0.148
Indirect effect	0.240	0.042	0.160	0.311
Path 1: Expression and creation→ Parent relationship→ Child peer quality	0.110	0.027	0.080	0.171
Path 2: Expression and creation→ Social emotional ability→ And child peer quality	0.090	0.022	0.054	0.135
Path 3: Expression and creation→ Child's relationship→ Social emotion ability→ Child peer quality	0.040	0.009	0.022	0.061

3.4.4 Chain mediation effects of integrated and expressive gamified dance rhythms

The results of the chain mediated effect analysis of integrated versus expressive gamified dance rhythms are shown in Table 13, where the total and indirect effects from integrated versus expressive to the quality of young children's peer interactions are significant. The direct effect value from integrated versus expressive to the quality of young children's peer interactions was 0.062, the total mediated effect value was the sum of the three paths, i.e., 0.173, and the total effect value was the sum of the direct effect value and the total mediated effect value, i.e., 0.235. The ratio of the mediating effect to the total effect was 73.62%, meaning that 73.62% of the effect of the combined and expressive to the quality of young children's peer interactions was mediated through the multiple mediators of the parent-child relationship and social-emotional competence. Among them, the mediating effect of integrated and expressive on the quality of young children's peer interactions through parent-child relationship was 0.092, accounting for 39.15% of the total effect; the mediating effect of integrated and expressive on the quality of young children's peer interactions through socio-emotional competence was 0.043, accounting for 18.30% of the total effect; and the chain mediating effect of integrated and expressive on

the quality of young children's peer interactions through parent-child relationship and socio-emotional competence was 0.038, accounting for 16.17% of the total effect.

Table 13: The chain intermediary effect of the combination and expressive game

	Effect value	Standard error	Confidence interval	
Total effect	0.235	0.043	0.163	0.310
Direct effect	0.062	0.038	-0.012	0.142
Indirect effect	0.173	0.035	0.115	0.223
Path 1: Integrated and phenotype→ Parent relationship→ Child peer quality	0.092	0.025	0.052	0.132
Path 2: Integrated and phenotype→ Social emotional ability→ And child peer quality	0.043	0.024	0.032	0.081
Path 3: Integrated and phenotype→ Child's relationship→ Social emotion ability→ Child peer quality	0.038	0.008	0.022	0.062

4 Responses to play-based dance rhythm education interventions

Dance rhythm education for young children is not just a simple imitation of movements, but is essentially a profound social-emotional learning time, in which not only the creativity and imagination of young children are cultivated, so that they are able to use their rich imagination to express their inner emotions. The basis of being able to achieve these effects is to enrich the actual daily life of young children, so that they can have more experience and knowledge of life. A professional kindergarten teacher, in the process of teaching game-based dance rhythm, needs to use various channels to create a teaching environment for children to experience real life, increase children's experience of life, enrich their emotions, and make the dance appear more soulful.

Inspirational teaching, enhance the creativity of young children regardless of the form of art, all need creativity and imagination. Dance as one of the most popular forms of art, to enhance the creativity and imagination of young children, effectively integrated in the teaching of dance rhythm, breaking the previous teaching methods of early childhood education, so that young children are no longer simply imitation learning, to ensure that rhythmic teaching to maintain its original artistic value and role. The use of heuristic teaching, teachers do not let children create their own, but after teaching children the basic movements, inspire children's inspiration for the movements, let children innovate on the basic movements, and cooperate with peers to complete the learning task, increase children's understanding of teamwork, division of labor, and other people's needs, and enrich their emotions to make them more socially attractive, so as to improve the quality of their peer interactions.

5 Conclusion

This study investigated the reality of social emotional competence, toddler's level of playful dance rhythm, social emotional competence and quality of toddler's peer interaction through the Questionnaire of Toddler's Level of Playful Dance Rhythm, Questionnaire of Social Emotional Competence and Questionnaire of Quality of Toddler's Peer Interaction, and

explored in depth the relationship between the three, and drew the following conclusions:

The results of descriptive statistics revealed that the level of playful dance rhythm, social-emotional competence and the quality of young children's peer interactions in general were in the middle to high level, showing positive development, but the score of social initiative was 2.74, which was significantly lower than the average level, and it could be used as a key entry point for educational intervention.

The results of the regression analysis provide a precise point of focus for educational interventions. Rhythm and coordination type significantly and positively predicted toddlers' verbal and nonverbal interaction skills, indicating the consistency of rhythm and coordination of movement, which enables toddlers to communicate effectively in social scenarios on the basis of their direct competence.

The direct effect of toddlers' level of playful dance rhythm on the quality of peer interactions was relatively limited, and its effect was also mediated through the chained mediation pathways of parent-child relationships and social-emotional competence. Active participation in playful dance rhythm activities helps to create high-quality parent-child interactions, which in turn provide young children with social-emotional social modeling. The activity itself also directly hones young children's emotional understanding, expression, and regulation, ultimately optimizing levels of social-emotional competence and parent-child relationships, and significantly contributing to young children's willingness to interact in groups, their interaction skills, and their pro-social behaviors. The pathway of children's level of playful dance rhythm → parent-child relationship → socio-emotional competence → peer interaction quality is the core mediating mechanism through which children's playful dance rhythm affects the quality of peer interactions.

Based on these mechanisms and findings, educational interventions should shift from pure movement training to the systematic cultivation of socio-emotional competence, based on life-enriching experiences, with “heuristic teaching” as the core and peer cooperation as the path of integration.

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