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ASSESSING THE BODILY-KINESTHETIC INTELLIGENCE OF PRE-SCHOOLERS

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Abstract:
The study focused on the presentation of an instrument developed to assess bodily-kinesthetic intelligence of pre-schoolers. There are presented activities and their evaluative procedure for the assessment of bodily-kinesthetic intelligence of preschool children. A secondary aim of this study was to evaluate, with the use of this instrument, a creative dance intervention programme which focused on the development of pre-schoolers' bodily-kinesthetic intelligence. The sample of this study consisted of 28 preschool children in total, split into intervention and control groups. In the intervention group there were 15 preschool children (7 boys and 8 girls), with an average age of 5 ± 0.5 years, and in the control group 13 children (7 boys and 6 girls). To examine the effect of the creative dance intervention program on the development of children's bodily-kinesthetic intelligence, data were analyzed with RM-ANOVA. By these means, we arrived at the conclusion that these creative dance sessions gave pre-school children the opportunity to employ and develop their bodily-kinesthetic intelligence.

Keywords: bodily-kinesthetic intelligence, preschool children, creative dance

1. Introduction

Bodily-kinesthetic intelligence is defined as the ability of the individual to use his/her body to solve problems, express ideas and emotions and manipulate objects. According to this definition, the main characteristic of this intelligence type is the ability to employ the body in different activities requiring skills to achieve a specific goal. The second characteristic of bodily-kinesthetic intelligence is the skill development in object manipulation (Gardner, 1983). Based on this definition, there is a close relation between bodily-kinesthetic intelligence and the aims and content of creative dance. Creative dance aims at the free kinetic expression of ideas and feelings through the exploration of the

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body and the kinetic abilities of the child. In addition, with the use of various objects (e.g., hoops, balls, scarves, newspapers) during creative dance sessions, children are able to familiarize themselves with the use of these objects and improve their manipulative abilities. Dance has certain characteristics relevant to the investigation of bodily-kinesthetic abilities. At an education level, dance has the potential to offer a unique body of knowledge and practice relating to bodily-kinesthetic intelligence (Blumenfeld, 2009). One of the main issues of multiple intelligence theory is the difficulty in finding valid and reliable ways of estimating the different intelligence types (Castejón, Pérez, & Gilar, 2010). Although many tools have been designed for the evaluation of different types of intelligence, only a few have been validated (Siti Rahayah, Ida Kamalawati, Mohd Sahardi, & Isa, 2010). A well-known evaluation tool, on the basis of work-performance, is Project Spectrum. The basic aim of Project Spectrum is the observation of students over a period, and their interaction when engaging in a variety of activities involving different types of intelligence. It is a theory-based approach to assessment and educational practice in early childhood, with the explicit goal of identifying the distinctive children's strengths and interests (Gardner, Feldman, & Krechevsky, 1998a).

Certain studies have been carried out based on Project Spectrum for the evaluation of bodily-kinesthetic intelligence (Almeida, Prieto, Ferreira, Bermejo, Ferrando, & Ferrándiz, 2010; Almeida, Ptieto, Ferreira, Bermejo, Ferrando, Ferrándiz, Bermejo, & Hernández, 2011; Castejón et al., 2010; Hassan & Maluf, 1999). Most of these studies employed the creative movement curriculum to evaluate bodily-kinesthetic intelligence and used graded observation scales, which focused on the performance of particular activities of Project Spectrum. Even though the above-mentioned studies tested the employed scales, providing initial validity and reliability evidence, they did not explain the process of developing these scales. For example, it was not clear under which criteria were the observational categories chosen and formed. Another issue was whether the researchers were adequately trained to conduct observations on creative movement. Moreover, despite the fact that the ability to manipulate objects is rated high in the definition of bodily-kinesthetic intelligence, this category was not included in the assessment of bodily-kinesthetic intelligence either in Project Spectrum, or in the above-mentioned studies. Therefore, a gap in the international literature currently exists between the definition and evaluation of bodily-kinesthetic intelligence.

The present study is also based on Project Spectrum (abilities and their criteria as observation categories of the bodily-kinesthetic intelligence) (Gardner, Feldman, & Krechevsky, 1998c). The article focused on the presentation of an instrument developed to assess bodily-kinesthetic intelligence of pre-schoolers. Before conducting the research, the relationship between the abilities and their criteria of bodily-kinesthetic intelligence and various other sources referred to these abilities was explored in a pilot study. We ended up with five observational categories and the respective criteria, in which it was added the ability to manipulate objects (Michelaki & Bournelli, 2016). A secondary aim of this study was to evaluate, with the use of this instrument, an intervention programme which focused on the development of pre-schoolers' bodily-kinesthetic intelligence.

2. Material and Methods

2.1. Participants

The sample of this study consisted of 28 preschool children in total, split into intervention and control groups. In the intervention group there were 15 preschool children (7 boys and 8 girls), with an average age of 5 ± 0.5 years, and in the control group 13 children (7 boys and 6 girls). All students were included in the experimental design study. Prior to participation, all children, as well as their parents or guardians, read the information sheet and signed an informed consent document approved by the Greek Ministry of Education, guaranteeing confidentiality and anonymity with the appropriate use of coding to track each child with the results of their testing in the database. The researchers also guaranteed that videos would be used only for research purposes and that children's names and faces would not be published.

2.2. Measurements

The instrument's construct and content validity were based on the observational framework provided by Gardner's theory of multiple types of intelligence (Gardner et al., 1998a; Gardner, Feldman, & Krechevsky, 1998b). Validity was further enhanced by a review of the literature, mainly by cross-referencing other theories on the general definition of intelligence and the abilities that prevail in dance (Bläsing, Calvo-Merino, Cross, Jola, Honisch, & Stephens, 2012; Castejón et al., 2010; Mc Grew, 2009; Kaufman, 2006). In this instrument, all five abilities and the respective 10 corresponding criteria reported in the pilot study (Michelaki & Bournelli, 2016) were included. These are presented in Table 1.

Table 1: The observational categories and their criteria for the research of bodily-kinesthetic intelligence (Michelaki & Bournelli, 2016)

Abilities	Items	Examines
1. Body control	c_1:	The ability to identify, isolate and use different parts of the body.
	c_2:	The ability to plan, sequence and execute movement efficiently (an effective performance of movement not just random and fragmentary but allowing the child to find balance, stay immobile, etc. when required).
	c_3:	The ability to replicate movements produced by the child itself and others.
2. Sensitivity to rhythm	r_1:	The ability to synchronize movements to stable or changing rhythms.
	r_2:	The ability to develop a personal rhythm through movement and regulate it for desired effects.
3. Expressiveness	e_1:	The ability to express feelings and images through movement (using body postures and gestures).
	e_2:	The ability to express feelings and moods through movement in response to different melodies.
4. Generation of movement ideas	g_1:	The ability to invent novel movement ideas or to offer extensions of ideas, which can be expressed either verbally or kinetically.
5. Object manipulation	om_1:	The ability to skilfully manipulate objects, using fine movements of the arms and hands.

	om_2:	The ability to skilfully manipulate objects, using gross body movements.

In addition to defining the abilities to be observed, it was also necessary to identify those activities on the basis of which the criteria of each bodily-kinesthetic intelligence ability would be assessed. The activities chosen for the assessment of bodily-kinesthetic intelligence were based on previous literature (Almeida et al., 2010, 2011; Castejón et al., 2010; Gardner et al., 1998a, 1998b, 1998c; Hassan & Maluf, 1999; McGrew, 2009; Venetsanou, Donti, & Koutsouba, 2014) and the opinions from expert physical education teachers. The researchers used four activities for each of the criteria (40 activities in total). Before the beginning of the main research, a content validity procedure was conducted for all activities. The selected activities were presented to ten participants, of which five were Physical Education and Dance professionals. Each one rated every activity on a five-point scale (1=not relevant; 2=somewhat relevant; 3=relevant; 4=somewhat relevant; 5=extremely relevant). Those activities that received an average of at least three points remained in the assessment instrument. For those activities that scored below three, the participants were asked to replace them with activities that they would consider to be more relevant (Ouzouni & Nakakis, 2011). No activity was given a score below three, so all activities were retained. Table 2 presents the entire bodily-kinesthetic intelligence instrument developed for preschoolers.

Table 2: The bodily-kinesthetic intelligence instrument

Abilities	**Items**	**Activities**
Body control	c_1:	1. Move your shoulders back and forth. 2. Place your palms on your head and bend your knees. 3. Join your elbow to your knee. 4. Lift your arm and your opposite leg.
	c_2:	1. Walk in space and when you hear the clap, stand still. 2. Walk in space and when you hear the clap, perform a balance. 3. Move down to the floor, then stand up and do the balance you did before. 4. Do a hop on both feet, when you hear the clap stop with both feet apart, and when you hear the clap again do a hop on both feet.
	c_3:	1. Repeat the movements that the instructor shows with his/her hands. 2. Repeat the movements that the instructor shows with his/her feet. 3. Repeat a balance shown by the instructor. 4. Repeat three different movements shown by the instructor (including hands, feet, and/or balance movements). *(Instructions: The instructor shows some movements and when (s)he stops the child will try to repeat the same movements.)*
Sensitivity to rhythm	r_1:	1. Walk to the rhythm the instructor gives with the tambourine. 2. Sit down and imagine you are in a boat and rowing. The captain of the boat (which will be the instructor) will give the rhythm with a drum and you have to follow the drum rhythm to paddle. 3. Listen carefully to the music and clap your hands according to the rhythm.

		4. Listen carefully to the music and move slowly to the slow part of the music and faster to the fast part of the music.
	r_2:	1. Move slowly like a turtle. 2. Move fast like a horse. 3. Imagine that you are a balloon that inflates very slowly and deflates very quickly (demonstration with hands). 4. Go from one line to the next as slowly as you can.
Expressiveness	e_1:	1. Move like a robot. 2. Fly like a bird. 3. You are a man walking initially happy, and then sad. 4. Walk like an elephant.
	e_2:	1. Move with sharp movements when you hear the staccato music. 2. Move with gentle movements when you hear a light melody. 3. Listen to a happy melody and move accordingly. 4. Listen to a sad melody and move accordingly.
Generation of movement ideas	g_1:	1. Think of a sport and try to present it to the instructor. 2. Show the instructor two parts of your body that can open and close. 3.The instructor shoes a body shape. Show him/her a body shape of your own. Make another one stranger and more original. 4. Show the instructor a movement that presents the words "stretch" and "bend". *(Instructions: correct motor responses are considered (when requested) when both exercise tasks are performed correctly, according to the instructors.)*
Object manipulation	om_1:	1. Spin the ball with your fingers quickly (the child holds the ball with outstretched hands in front of his/her chest, using both hands fingers). 2. Hold the hoop with one hand (arm parallel to the torso) and, without changing the way you hold it, try to rotate it with your palm and fingers. 3. Lift the hoop off the ground using only one finger. Now lift it up using two fingers. 4. Hold the hoop with both hands and spin it as fast as you can (the child holds the hoop in front of him/her with outstretched hands, one hand on one side of the hoop and the other hand on the other side, and holds it mainly with the fingers).
	om_2:	1. Throw the ball up (not too high) with both hands and try to catch it. 2. Hold the hoop with one hand extended forward (handle down) and without changing the way you hold it, bring the hoop to the side. 3. Roll the ball you are holding so that it touches the other ball (target one ball with the other ball). 4. From one line to the other line, kick the ball as many times as you can using both left and right foot interchangeably. *(Instructions: all exercises in object manipulation are presented to the children by the instructor. In the third and fourth activities, the distance between the parallel lines is two meters. In the fourth exercise, the child performs correctly when he/she manages to kick the ball at least three times with every foot.)*

2.3. Procedure

The assessment of bodily-kinesthetic intelligence for each criterion in both the pre- and post-intervention measurements was based on a four-point scale (1=the child cannot perform any activity correctly or can perform only one activity correctly; 2=the child can perform two activities correctly; 3=the child can perform three activities correctly; and

4=the child can perform all four activities correctly). Each child performed each activity separately (without the presence of other children) and all children in the study performed all activities. The procedure was videotaped to avoid any errors. Two Physical Education teachers participated in the evaluation process: the main researcher and a Physical Education teacher specialized in creative dance.

More specifically, the assessment by the two observers was done in the following order: one observer informed the child about the activity to be performed, the child performed the activity, and then if the observer thought that the child performed the activity correctly, the observer marked the letter *X* on the score sheet. In the event that the observer thought the child did not perform the activity correctly, (s)he would mark a dash (**-**). Simultaneously, the second observer, independently of the first, assessed on his/her own the child's performance, in the same way. In the following activity, observers switched roles so that the measurements were counter-balanced (Castejón et al., 2010). The number of *X*'s that each observer had scored on each criterion was summed up to create the child's overall score on each criterion of bodily-kinesthetic intelligence.

2.4. Statistical analysis

Every child got an overall score on bodily-kinesthetic intelligence as follows: on every criterion by the average of the scores of the two observers, on every ability by the average of the criterion scores corresponding to that specific ability, and on the overall bodily-kinesthetic intelligence score by the sum of the ability scores.

The following tests were carried out, with the use of SPSS version 23.0 for Windows (IBM SPSS Corp., Armonk, NY, USA): (1) normality test (normal distribution test and scatter plots); (2) reliability tests (between-rater reliability and internal consistency scale reliability test); (3) test of differences between the intervention and the control group at baseline (pre-intervention) in the total value of bodily-kinesthetic intelligence (t-tests); and (4) in order to examine the effect of the creative dance intervention program on the development of children's bodily-kinesthetic intelligence, the pre- and post- intervention data were analyzed with repeated measures ANOVA (RM-ANOVA), with the "Measurement" factor as the within-subjects factor and the "Group" factor as the between-subjects factor. The significance level was set at $p<0.05$ and the partial η^2 was presented as a measure of effect size for F-tests.

3. Results

3.1. Normality test

In order to test the normality of the distributions of the variables under examination, tests of normality of the distribution of the variables and their respective boxplots were computed. The Shapiro-Wilk test was selected for testing normality, because it is considered the most suitable statistical indicator in the case of small samples ($n<30$), since in the present study the sample consisted of 28 students. The Shapiro-Wilks tests and the respective scatter plots showed that for all variables, normality was verified, which allowed for parametric analyses to be conducted.

3.2. Instrument's reliability

Pearson r correlation coefficients were calculated to test the reliability between the two raters (inter-rater reliability), which supported the high correlation between the two observers' scores on each criterion (pre-test measurements). The results of the correlation coefficients (Pearson's r) on the bodily-kinesthetic intelligence criteria to test the inter-rater reliability between the two raters are presented in Table 3. As presented in Table 3, all Pearson r correlation coefficients have values between 0.70 to 0.97. Based on these results, it can be concluded that the four-point instrument, with which the two observers rated the bodily-kinesthetic intelligence in each criterion, showed acceptable to high inter-observer reliability and can be considered a reliable instrument in the context of this study.

Table 3: Pearson r inter-rater reliability for the entire bodily-kinesthetic instrument between the two observers (pre-test measurements)

	Bodily-kinesthetic intelligence criteria									
	$c_1.2$	$c_2.2$	$c_3.2$	$r_1.2$	$r_2.2$	$e_1.2$	$e_2.2$	g.2	$om_1.2$	$om_2.2$
$c_1.1$	0.97^{***}									
$c_2.1$		0.93^{***}								
$c_3.1$			0.91^{***}							
$r_1.1$				0.87^{***}						
$r_2.1$					0.79^{***}					
$e_1.1$						0.70^{**}				
$e_2.1$							0.88^{***}			
$g_1.1$								0.70^{**}		
$om_1.1$									0.80^{**}	
$om_2.1$										0.95^{***}

** $p < 0.01$, *** $p < 0.001$
$c_1.1$ to $om_2.1$: 1st observer's rating
$c_1.2$ to $om_2.2$: 2nd observer's rating

To further explore the reliability of the instrument, the Cronbach's α internal consistency coefficient was calculated (pre-intervention measurements). In addition, the Cronbach α coefficient was checked by deleting one variable at a time to control for possible improvement of the instrument's internal consistency. If the removal of a variable was expected to lead to a significant increase in Cronbach's α values, then that variable would be removed unless there were theoretical reasons for its retention.

The results of the Cronbach's α internal consistency coefficients of the entire bodily-kinesthetic intelligence instrument are listed in Table 4. In the first column of Table 4, it can be observed that the overall value of Cronbach's α was 0.73 (0.70 was the minimum acceptable threshold), supporting the adequate internal consistency of the bodily-kinesthetic intelligence instrument. The second column presents the value of Cronbach's α coefficient if the variable in question was removed. The results note that in no case does internal consistency improve, so all variables remained in the instrument. Consequently, we can argue that all five variables contribute to the overall bodily-kinesthetic assessment.

Table 4: Bodily-kinesthetic instrument's Cronbach α internal consistency coefficient (pre-test measurements)

Cronbach α	**Cronbach α if variable deleted**	
Overall bodily-kinesthetic intelligence **0.73**	Body control	0.69
	Sensitivity to rhythm	0.60
	Expressiveness	0.71
	Generation of movement ideas	0.59
	Object manipulation	0.77

3.3. Baseline bodily-kinesthetic results

An independent samples t-test was performed for the total value of bodily-kinesthetic intelligence during the pre-test measurement, before the implementation of the creative dance program. The aim of this analysis was to examine possible differences in the total value of bodily-kinesthetic intelligence between the intervention and the control groups. No statistically significant difference was observed between the intervention group (M=11.15, SD=1.04) and the control group's (M=10.74, SD=1.56) overall bodily-kinesthetic intelligence ($t(26)=0.82$, $p>0.05$).

3.4. Repeated measures ANOVA for somatic-kinesthetic results between the two groups

To examine the effect of the creative dance intervention program on the development of children's bodily-kinesthetic intelligence, data were analyzed with RM-ANOVA, with the "Measurement" factor as the within-subjects factor and the "Group" factor as the between-subjects factor. The results of the RM-ANOVA (pre- and post-measurement) of the two research groups (intervention and control) are presented in Table 5.

For the overall value of bodily-kinesthetic intelligence score, there was a statistically significant interaction between the experimental condition (intervention and control groups) and repeated measures ($F(1,24)=158.990$, $p<0.001$, $\eta 2=0.869$). More specifically, 86.9% of the total variance was explained, noting that there were statistically significant changes in the mean values of the overall bodily-kinesthetic intelligence between pre- and post-measurement, which were not equal for both groups. Between pre- and post-measurement there was a significant improvement for the intervention group, which showed a large increase in the overall value of bodily-kinesthetic intelligence, while the control group's value did not change significantly. The high rate of the total variance confirmed that there was a significant increase in the overall value of bodily-kinesthetic intelligence of children in the intervention group, as opposed to the control group, and most probably this result was due to the effect of the creative dance program.

Table 5: Means (M) and standard deviations (SD) for the five abilities of bodily-kinesthetic intelligence, and the overall bodily-kinesthetic intelligence score, pre- and post-measurement, for the intervention and control groups

	Pre-measurement					**Post-measurement**				
	Intervention group			**Control group**		**Intervention group**			**Control group**	
	M	*SD*		*M*	*SD*	*M*	*SD*		*M*	*SD*
Body control	223	0.29		1.97	0.34	3.33	3.33		2.13	0.52
Sensitivity to rhythm	2.18	0.36		2.23	0.41	3.63	3.63		2.48	0.70
Expressiveness	2.03	0.25		2.12	0.35	3.48	3.48		2.27	0.59
Generation of movement ideas	2.40	0.47		2.38	0.55	3.90	3.90		2.92	0.81
Object manipulation	2.30	0.25		2.04	0.38	3.45	3.45		2.08	0.55
Overall bodily-kinesthetic intelligence score	11.15	1.04		10.74	1.56	17.80	17.80		11.88	2.26

In all analyses of the separate five abilities, a statistically significant interaction between the intervention condition (intervention group and control group) and the repeated measures (pre- and post-measurement) was found. More specifically, between pre- and post-measurement there are statistically significant changes in the mean values of bodily-kinesthetic intelligence in every ability, which were not equal for both groups. Between the pre- to post-measurement there was a significant improvement for the intervention group, which showed a large increase in bodily-kinesthetic intelligence, while no significant change was observed for the control group. The variance explained by the model was high for all five abilities: Expressiveness (75.4%), Sensitivity to rhythm (69.2%), Object manipulation (69%), and Body control (61.1%). On the other hand, the variance explained was not equally high in Generation of movement ideas (52.5%).

4. Discussion

Regarding children's development of bodily-kinesthetic intelligence, which was measured with the current assessment of bodily-kinesthetic intelligence, the following results were supported. In all five bodily-kinesthetic intelligence abilities, between the pre- and post-intervention measurement, there were statistically significant changes in the mean values of bodily-kinesthetic intelligence, which were not equal for the intervention and control groups. Between the pre- and post-measurement in all five abilities, there was a significant improvement for the intervention group, which increased significantly the bodily-kinesthetic intelligence, while in the control group a statistically significant improvement was not observed. The variance explained by the model was high in most abilities: Expressiveness (75.4%), Sensitivity to rhythm (69.2%), Object manipulation (69%) and Body control (61.1%). However, it was not similarly high in the ability Generation of movement ideas (52.5%).

Additionally, there were, between the pre- and post-measurement, statistically significant changes in the mean values of the overall bodily-kinesthetic intelligence results, which were not equal for the intervention and control groups. Between the pre-

measurement and the post-measurement there was a significant improvement in the intervention group, which showed a large increase in the overall value of bodily-kinesthetic intelligence, while the control group did not show a significant improvement. The high level of total variance explained (86.9%) confirmed that there was a significant increase in children's bodily-kinesthetic intelligence in the intervention group, in comparison to the control group.

Lastly, regarding the gender effect, no statistically significant interaction between gender and bodily-kinesthetic intelligence was observed.

Based on the findings of this study, theoretical and practical recommendations, further research ideas, new approaches, suggestions and concerns regarding potential social and cultural impacts, have emerged.

5. Recommendations

The following suggestions for future research are presented:

- Future studies should include a larger and more diverse sample, as well as a larger number of classes in the creative dance (intervention) programme, which might assist in the increase of generalizability of the results in other settings.
- Further research on the establishment of a valid and reliable test to assess bodily-kinesthetic intelligence will require:
    1) Re-examination of some activities. In criterion e_1 regarding the ability Expressiveness and in criterion g_1 of the ability Generation of movement ideas, when applying the bodily-kinesthetic intelligence assessment to test the reliability between the two observers, the Pearson's r correlation coefficient was low. We could speculate that some of the activities that were chosen to assess these criteria in the test of bodily-kinesthetic intelligence may not be appropriate. In future studies, these activities could be replaced with different ones (e.g., with activities taken from the lessons of the creative dance programme applied in the research).
    2) Observers who will assess children's bodily-kinesthetic intelligence should be familiar with the procedure. In the assessment of bodily-kinesthetic intelligence, it was observed that the mean values of bodily-kinesthetic intelligence in the initial pre-measurement were high. This might suggest that the two observers overestimated students' initial bodily-kinesthetic intelligence levels. Possibly this phenomenon could be attributed to observers' emotional factors (i.e., the first meeting with the children might have an emotional impact on the observers). Another possible explanation could be the observers' lack of experience with the assessment process, because the bodily-kinesthetic intelligence instrument was designed and implemented only in the main study, and was not tested before in a pilot study.

6. Conclusion

In conclusion, this study aimed to cultivate children's bodily-kinesthetic intelligence through the implementation of a special creative dance programme. The results confirmed that the bodily-kinesthetic intelligence of 5-6-year-old preschool children can be enhanced through this specific programme and similar programmes might be a viable solution for the overall increase of children's bodily-kinesthetic intelligence. The bodily-kinesthetic intelligence related to dance, it could be supported that creative dance covers their entire spectrum and, therefore, through creative dance the appropriate conditions for the activation and development of bodily-kinesthetic intelligence are developed.

Through this study, there are presented activities and their evaluative procedure for the assessment of bodily-kinesthetic intelligence. These are recommended to the researchers and educators who wish to assess the bodily-kinesthetic intelligence of preschool children as well as for those who wish to progress the research for bodily-kinesthetic intelligence.

Conflict of Interest Statement
The authors declare no conflicts of interest.

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