



# Influence of a 12-week bodily-kinesthetic intelligence-oriented teaching approach on fundamental movement skill development in children

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## ABSTRACT

Early childhood developmental fundamental movement competence is one of the most important predictors of physical literacy and the conscientious retention of physical activity in the future. Current physical education curriculums, however, tend to poorly incorporate cognitive and kinaesthetic learning activities which help develop a comprehensive motor sense. This study was done to discuss the influence of a 12 weeks bodily-kinaesthetic intelligence (BKI)-based physical education intervention on the fundamental movement skills of the early school-aged children. A randomized pre-test- post-test control-group study was conducted in a sample of 100 children with ages between 6 and 8 years where half ( $n = 50$ ) was experimental (BKI-based programme) and the other half ( $n = 50$ ) was control (traditional physical education). The intervention was provided three times a week and lasted 45 minutes in 12 weeks. The Test of Gross Motor Development-Second Edition (TGMD-2) was used to determine locomotor and object-control skills. Data analysis entailed paired and independent t-tests and analysis of covariance (ANCOVA), and the effect size of paired and independent t-tests were calculated by use of Cohen  $d$ . The findings showed a statistically significant change in the experimental group as compared to the control group ( $p < .001$ ) in locomotor skills and ANCOVA supported the fact that the intervention has a significant effect after adjusting the baseline performance. Object-control skills showed no significant differences between groups anyway. These results suggest greater efficiency of the incorporation of the bodily-kinaesthetic intelligence principles into early-stage physical education to facilitate the locomotor movement competency and promote the developmentally suitable and cognitively interested motor-learning milieu at schools.

**Keywords:** Physical education, Fundamental movement skills, Bodily-kinaesthetic intelligence, Physical literacy, Motor development, School-aged children.

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## INTRODUCTION

The basis of physical developments in children involves basic movement skills ( FMS ) which form the basis of lifetime participation in the activities of physical activity, sporting roles and health. Such skills as locomotor, object-control, and stability movements facilitate the interaction system among children with the environment and become the foundations of physical literacy, meaning the motivation, confidence, physical ability, knowledge, and comprehension necessary to appreciate and take ownership of involvement in physical activity throughout life (Bailey, 2020; Newell, 2020). It is proven continuously that children with adequate competency in movement in early school ages are more capable to remain physically and cognitively and psychosocially active throughout their growth (Bremer and Cairney, 2018; Wick et al., 2017).

However, despite the common understanding of the significance of FMS, the studies reveal that most of the modern-day physical education (PE) programmes fail to assist in the systematic development of the latter, especially in the early childhood stage (Brian, 2021; Martínez-Bello & Estevan, 2021). The conventional PE classes usually depend on free play or sport related exercises that focus on either the number of participants, or the results of their performance, rather than on the qualitative learning of movement patterns. Although these methods help to encourage fun, they do not always advance sticky, versatile, and relocatable motor capabilities (Cocker, 2018). As a result, a significant part of children approaches adolescence's stage in the form of incompetency in movement, which was reconciled to diminished physical activity, diminished fitness, and enhanced sedentary behaviour in the next phase of life (Adank et al., 2018; Praxades et al., 2024).

The recent pedagogical changes have portrayed approaches based on physical literacy that involve an integration of motor learning into the process of cognitive and affective processes (Bailey, 2020). In that context, one of the fundamental abilities of human beings, as a theory by Gardner, is bodily-kinaesthetic intelligence (BKI) that refers to the efficient application of the body in purposeful movement, solving problems, and being in action (Gardner, 2011; Macedonia, 2019). Movement is a natural way that children learn, explore, and communicate, implying that PE programmes that are based on BKI principles could offer an appropriate pathway of developmentally relevant and cognitively interesting ways to acquire motor skills (Nista-Piccolo, 2020; Li and Siriphan, 2023). The implementation of BKI into PE can promote the feeling of going beyond the repeated practice of mechanical skills and promote the awareness of the body, spatial orientation, rhythmic coordination, and mindful movement practice (Light and Clarke, 2021; León et al., 2024).

Early school age is a vulnerable stage of motorization and neural, musculoskeletal, and perceptual systems show increased plasticity (Martínez-Bello and Estevan, 2021). The motor mastery that children get at this age is deeply predictive of physical involvement later in life and participation in sports (Hands, 2008). By contrast, a lack of exposure to structured and developmentally sequenced motor learning experiences could be one of the factors involved in the chronic movement deficits (Neville et al., 2019). These disparities are accelerated by socioeconomic and contextual factors, and the interventions based on inclusion and implemented at the school level can be introduced (Matarma et al., 2020).

The practical activities are supported using empirical evidence that shows the efficacy of structured motor programmes compared with unstructured activity in enhancing movement competency in children. The interventions based on the progressive difficulty of the tasks and variability of the movements and object-control challenges proved to have better outcome in the area of coordination, balance, or object-control skills than the traditional PE methods (Jahagirdar et al., 2017; Kouli et al., 2024). Nonetheless, most of the current programmes widely focus on the physical realm of motor learning, frequently neglecting the mental and emotional aspects that contribute to the ways children experience, control and store learning about

movement (He et al., 2023; Akil et al., 2024). Through the instruction based on BKI, the pedagogical framework combines these domains, according to which it is possible to place the movement as a physical as well as a cognitive learning process (Moreau, 2015; Pereira et al., 2024).

The evaluation of movement competency among children is typically based on specific validated tools, including the Test of Gross Motor Development, Second Edition (TGMD-2), which is able to give individual and valid results on locomotor and object-control skills (Field et al., 2020; Palmer et al., 2021). The TGMD-2 has been extensively utilized in the field of intervention research, having been used to assess change in motor performance in those populations considered to be at suitable ages (Todd et al., 2003). The objective comparison of instructional strategies and evidence-based assessment of curriculum performance can be achieved through its application (Staples et al., 2021). Even though theoretical and empirical evidence has been published to associate the applicability of bodily-kinaesthetic intelligence to motor learning, there are a few studies that have been experimental and analysed structured BKI-based interventions in school PE programs (Michelaki and Bournelli, 2022; Yudanto, 2023). Specifically, controlled research studies that explore the possibility of obtaining any positive result into the application of fundamental movement skills with the application of BKI principles into the regular PE classes instead of the conventional ones need to be conducted. Thus, the aim of the current research was to study the outcomes of 12 weeks bodily-kinaesthetic intelligence physical education intervention on locomotor and object-control skills of early school children. The hypothesis was that the children who attended BKI-based programme would show more improvement in movement competency than those who were getting the typical physical education teaching intervention. In filling this gap, the study will help provide a body of evidence supporting the utilization of motor skills development using cognitively engaging, developmentally autonomous and inclusive methods in the physical education instruction in schools.

## **MATERIALS AND METHODS**

### ***Study design***

The study was based on a randomized experimental design that utilized a pre-text post-test control-group design to investigate the influences of bodily-kinaesthetic intelligence (BKI) based bodily education intervention on children movement competency. It was carried out in a 12-week period between January and March 2025 in one of the primary schools that were privately owned in Chennai, India. An experimental group (which received the BKI-based programme) and a control group (which pursued a regular physical education program at school) were assigned to the participants randomly. The two groups were involved in three physical education sessions at 45 minutes per week with these sessions being conducted during school hours. The study design was chosen so as to reduce selection bias and make a causal inference about the effects of the intervention.

### ***Participants***

One hundred children between 6 and 8 years (Grades 1 to 3) were selected purposely in Seed Academy, Chennai, comprising of 50 boys and 50 girls. The eligibility criteria were: (a) medically qualified to engage in physical activity; (b) no known neurological, musculoskeletal or developmental disorder; and (c) must be able to attend at least 85 per cent of the intervention time. The children undergoing external sports training or having this process as a rehabilitation of injury were not eligible to participate. The participants were then selected through simple lottery to allocate participants to the experimental group ( $n = 50$ ; 25 boys, 25 girls) and the testing condition, control group ( $n = 50$ , 25 boys, 25 girls). At the baseline, age, height, and body mass did not differ significantly between the groups ( $p > .05$ ). Parents or guardians signed informed consent in writing and all children volunteering were required to give verbal consent before participation. The study

had an ethical approval of the Institutional Human Ethics Committee of Hindustan Institute of Technology and Science (Ref: HITS/PE-2025-03). A detailed description of all the procedures was done within the framework of the principles approved in the Declaration of Helsinki (2013). Figure 1 depicts the movement of the participants in the study, the allocation, and intervention stages, as well as the assessment of the outcome of the study.

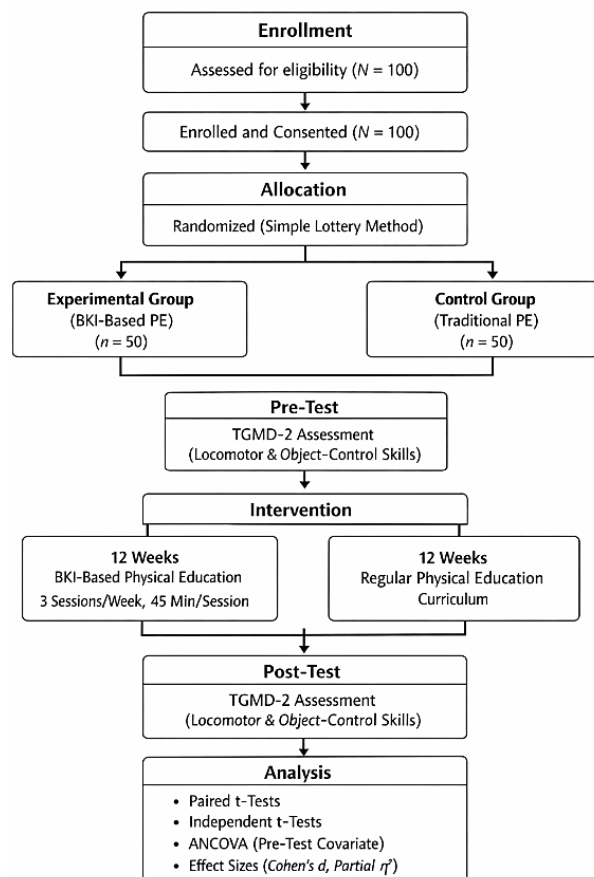


Figure 1. Flow diagram illustrating participant allocation, intervention phases, and outcome assessment.

### **Intervention protocol**

The experimental group was engaged in a structured BKI-based physical education programme that was developed in line with the principles of psychomotor learning and the theory of multiple intelligences that conceptualises the bodily-kinaesthetic intelligences as the ability to make effective use of the body in learning and solving problems, and expressive movement (Gardner, 2011). The intervention was intended to improve movement competency with the use of activities that would focus on body awareness, spatial orientation, rhythm, and reflective movement execution. Every session (45 minutes) had a standardized format of Warm-up (5 minutes) Rhythmic mobility exercises and active stretching to stimulate joint mobility, neuromuscular preparation and coordination. Core activity (35 minutes): Developmentally ordered activities focused on locomotor skills, object-control skills, spatial awareness, and kinaesthetic memory using play-based and cognitively stimulating movement types of activities. Cool-down (5 minutes): Static stretching and guided breathing to help people recover physically and help ratify mind-body integration. The intervention went through the stages of progression in the simplest to more complex motor patterns throughout the 12 weeks of time in order to encourage the gradual development of skills and their retention. Education was conducted

by qualified physical education teachers who were followed using the BKI framework and the activities were modified to be safe, inclusive, and age appropriate. The control group adhered to the usual curriculum in the school physical education program that involved free play, calisthenics, and simple games (e.g., running, jumping, and balls playing) without systematic development of skills, reflective ones, and specific cognitive activity.

### **Outcome measures**

The Test of Gross Motor Development-Second Edition (TGMD-2) has been extensively evaluated and is a reliable measure of gross motor development in children aged 3 to 10 years, which is why fundamentals of movement abilities have been tested using this tool (Ulrich, 2000; Field et al., 2020). The TGMD-2 has two subscales: locomotor skills (i.e. running and hopping and galloping), and object-control skills (i.e. throwing, catching, kicking, etc.). Evaluations were carried out an entire week prior to and a week following the period of intervention in a controlled setting by trained assessment blinded to the group assignment. The scores of performances have been rated based on the TGMD-2 protocol where the higher the score the higher is the movement competency.

### **Statistical analysis**

The SPSS Statistics (Version 26.0) was used in data analysis. All the demographic and performance variables were analysed using descriptive statistics (mean  $\pm$  standard deviation). To analyse within-group changes between pre- and post-tests, paired-sample t-tests were tested, whereas between-group changes between controls and experimental groups at baseline were tested in independent-sample t-tests. Analysis of covariance (ANCOVA) was performed to evaluate the pre-test scores as covariates so as to establish the impact of the intervention by abiding by the knowledge of baseline performance. The degree of effect was computed with the help of Cohen *d* of t-tests as well as the partial eta squared ( $\eta^2$ ) of ANCOVA in accordance with traditional interpretive limits (Cohen, 1988). The statistical significance was predetermined as  $p < .05$ . The Shapiro-Wilk test of assumptions of a normal distribution and Levene test of tests of homogeneity variance of variance, respectively, were used to test the assumptions.

### **Quality control and reliability**

The same group of trained evaluators carried out all tests in the same testing environment. Safety checks and equipment calibration were done every time there was a testing session. Fidelity to intervention was observed by the weekly supervision meeting to be compliant with the programme structure proposed. Assessors were blinded on group allocation during the data collection process to minimize the bias of measurement.

## **RESULTS**

Before the inferential analysis, the assumptions that must be taken in parametric statistical test were checked. The Shapiro-Wilk test was used to verify that the locomotor and object-control skill scores were normally distributed between the two in the pre-test and post-test ( $p > .05$ ). The homogeneity of variances was checked by the Levene test and no significant violations have been detected ( $p > .05$ ). These findings justified the use of paired sample t-tests and analysis of covariance (ANCOVA).

To ensure that there was a similarity between the experimental and control group before the intervention, baseline comparisons were done. Analysis using the independent-sample t-tests showed no statistically significant differences among the groups in terms of locomotor or object-control skills at baseline ( $p > .05$ ) which showed that there were no differences between the groups at the time they joined the study (Table 1).

Table 1. Baseline characteristics of participants.

Variable	Group	N	Mean	SD	p-value
Locomotor skills (Pre-test)	Experimental	50	19.76	3.46	>.05
	Control	50	18.16	3.87	
Object-control skills (Pre-test)	Experimental	50	24.52	3.07	>.05
	Control	50	21.04	4.48	

Note. No statistically significant baseline differences were observed between groups.

Table 2. Pre-post comparison of locomotor and object-control skills within groups.

Skill domain	Group	Test	N	Mean	SD	t	df	p-value
Locomotor	Experimental	Pre-test	50	19.76	3.46	-22.21	49	<.001
		Post-test	50	28.92	3.76			
	Control	Pre-test	50	18.16	3.87	0.65	49	.518
		Post-test	50	17.74	4.13			
Object-control	Experimental	Pre-test	50	24.52	3.07	-1.05	49	.300
		Post-test	50	35.14	3.43			
	Control	Pre-test	50	21.04	4.48	1.05	49	.300
		Post-test	50	20.36	4.43			

Note. Statistical significance was set at  $p < .05$ ;  $**p < .001$ .

Paired-sample t-tests were analyzed to compare the pre and post-intervention locomotor and object-control skills between the groups. Experimental section showed statistically significant locomotor skill improvement whereby the mean scores of locomotor skills at pre-test stage became 19.76 +3.46 and at the post-test 28.92 +3.76 ( $T = -22.21$ ,  $p = .001$ ). Conversely, the change in locomotor skills was not statistically significant in the control group ( $t(49) = 0.65$ ,  $p = .518$ ), as the scores did not change significantly throughout the intervention. In case of object-control skills, the experimental group ( $t(49) = -1.05$ ,  $p = .300$ ) and the control group ( $t(49) = 1.05$ ,  $p = .300$ ) did not indicate statistically significant changes of the test scores in the pre- and post-test. These findings suggest that locomotor skills rather than object-control skills improved when related to the BKI-based intervention to a greater extent (Table 2).

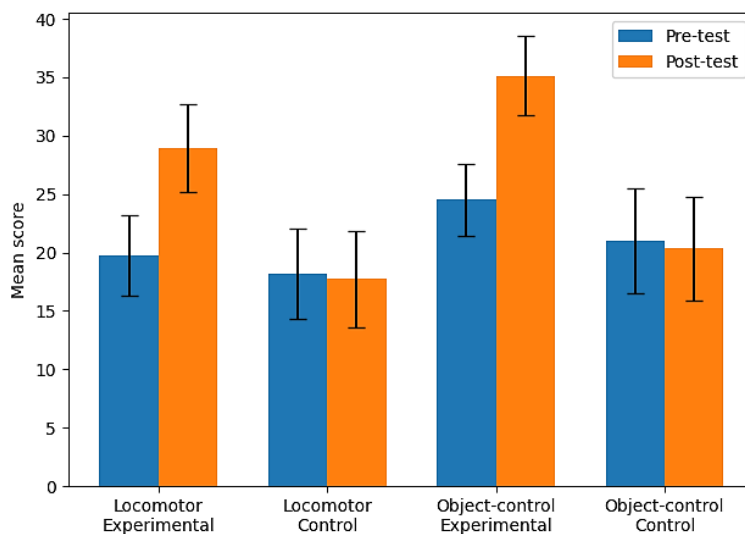


Figure 2. Pre- and post-test comparison of locomotor and object-control skill scores within experimental and control groups.

Figure 2 depicts changes in locomotor and object-control skills before and after the interventions in the experimental and a control group.

Table 3. ANCOVA for post-test locomotor skills controlling for pre-test scores.

Source	Sum of Squares	df	Mean Square	F	p-value	$\eta^2$
Group	414.40	1	414.40	37.10	<.001	.101
Error	1084.00	97	11.18			

Note. Statistical significance was set at  $p < .05$ .

ANOVA of pre-test scores as a covariate on post-test locomotor scores was conducted to identify the intervention effect controlling it by the baseline difference. The comparison indicated a large primary effect of group ( $F(1, 97) = 37.10$ ,  $p$  less than .001). The eta squared value ( $\eta^2 = .101$ ) was a partial one, which meant that only about 10.1% of the variance in post-test locomotor performance could be linked to the involvement in the BKI-based programme and this represents a significant educational effect (Table 3).

Table 4. ANCOVA for post-test object-control skills controlling for pre-test scores.

Source	Sum of Squares	df	Mean Square	F	p-value	$\eta^2$
Group	623.22	1	623.22	64.70	<.001	.127
Error	934.00	97	9.63			

Note. Statistical significance was set at  $p < .05$ .

An ANCOVA on post-test object-control scores in which pre-test scores were used as a covariate showed that the group effect was statistically significant ( $F(1, 97) = 64.70$ ,  $p < .001$ ). The effect size ( $\eta^2 = .127$ ) showed that 12.7% of the variance in the post-test object-control performance was dependent on the group membership (Table 4). Although statistically significant, the change was small as compared to the locomotor skill results. The findings show that the 12-week physical education programme based on bodily-kinaesthetic intelligence brought about significant improvement in locomotor skills to early school-aged children and the improvement was statistically significant compared to physical education as usual. The results regarding the object-control skills showed less consistency with no significant within-group change, but statistically significant between-group changes after controlling the baseline performance. In general, the intervention had a greater and more significant impact on locomotor movement competency compared to tutoring object-control abilities.

## DISCUSSION

The present research was aimed at studying the body-kinaesthetic intelligence (BKI)-based bodily-kinaesthetic programme of bodily-kinaesthetic intelligence physical education as an effective way to teach fundamental movement skills in early school-aged kids (Bailey, 2020; Bremer and Cairney, 2018; Newell, 2020). The main results reveal that the intervention resulted in statistically significant and significant change in the locomotor performance, but no systematic within-group change was observed in the object-control performance, although the difference between groups after accounting performance at the baseline was statistically significant (Hands, 2008; Wick et al., 2017). These results partly substantiate the hypothesis of the study and emphasize the effects specific to the field BKI-based instruction has with regard to movement competency (Brian, 2021).

The most prominent result of this analysis was the significant locomotor skill improvement in children that underwent BKI-based programme. The experimental group recorded high pre-post locomotor performance

when compared to the control group which recorded no significant change during the same period. Moreover, the outputs of ANCOVA confirmed that group membership explained about 10% of the post-test locomotor score, which proved that there was a significant educational effect due to other factors, rather than the developmental processes per se (Cohen, 1988; Praxedes et al., 2024). The findings are part of the tools of the literature stressing the efficiency of the structured, developmentally sequenced motor interventions in the process of improving locomotor competence in early childhood (Jahagirdar et al., 2017; Kouli et al., 2024; Martínez-Bello and Estevan, 2021). The locomotor skills of running, hopping, and galloping are very sensitive to the teaching strategies based on the repetition, progression, and qualitative movement feedback (Newell, 2020; Williams et al., 2021). It could be expected that the BKI framework employed in the current article led to improve such processes by promoting body awareness, spatial orientation, and rhythm coordination, thus allowing to experience more efficient acquisition of motor patterns (Gardner, 2011; Macedonia, 2019).

Pedagogically, the findings have upheld the assumption that when cognitive involvement is combined with physical performance in motor learning, improvement in motor learning is achieved. The BKI-based activities might have been able to facilitate better muscle coordination and consistency of movement through the focus on the conscious exploration of movement instead of motor performance evaluating (Light and Clarke, 2021; Moreau, 2015). This result is aligned with the models founded on physical literacy screening locomotor competence as one of the core elements of lifelong engagement in physical activities (Bailey, 2020; Bremer and Cairney, 2018). Unlike in the locomotor outcome, object-control skills failed to exhibit statistically significant pre- to post- differences in both groups. Despite the fact that the experimental group showed increases in data descriptively, the variability of each individual performance inhibited the ability to consistently monitor the changes. Such a trend indicates that object-control skills might need the addition of a more extended intervention period, increased specificity of tasks, or an increased intensity of practices to provoke strong outcomes (Coker, 2018; Neville et al., 2019).

The ANCOVA findings indicated that there is a statistically significant between group effect of the object-control skills following a baseline performance factor. The size of this effect was, however, small compared to the locomotor outcomes meaning that statistical significance did not automatically mean that there is a large practical benefit. This difference supports the significance of the interpretation of statistical results, as well as the effect size and within-group trends, especially when research methods regarded are school-based interventions (Cohen, 1988; Field et al., 2020). The ability to control objects, e.g. throwing and catching, is more complicated by nature and requires greater perceptual-motor integration, timing, and interaction with the environment (Hands, 2008; Palmer et al., 2021). Although the BKI system has a cognitive and kinaesthetic component, the structure of the programme used in the study might have contributed to the preference of overall body movement patterns, rather than focusing on the precision of manipulative skills. Therefore, the positive results of object-control were perhaps limited due to rather scanty exposure to the task-specific manipulative exercises (Brian, 2021; Neville et al., 2019).

The locomotor and object-control skills differentiability detected in this research is in line with the previous studies showing that there is no even development of fundamental domains of movement skills (Wick et al., 2017; Praxedes et al., 2024). Locomotor skills are usually acquired earlier and react to systematic training simpler and faster, whereas object-control skills may take a long time to develop under specific training and require guidance (Brian, 2021; Kouli et al., 2024). The current results support the originality of domain-specific programming creation in case of pursuing a balanced development of movement competency. Significantly, the findings indicate that the BKI-based interventions could be especially effective in terms of improving the quality of the locomotor movement in young children during the early school-aged. This has significant implications on curriculum design, since locomotor competence is a bridge to the involvement to many

physical activities and sporting activities (Hands, 2008). The further enhancement of this area in early childhood can thus result in some large-scale physical literacy outcomes (Bailey, 2020).

In educational terms, the results suggest that a BKI-based physical education programme can be effectively introduced into the normal school routine and yield significant changes in movement competency without the use of special gear (Nista-Piccolo, 2020; Matarma et al., 2020). The focus on body awareness, rhythm, and spatial control is also compatible with such inclusive pedagogical practices that should accommodate different levels of abilities and the learning styles (Li and Siriphan, 2023). Its lack of object-control gains could help demonstrate the significance of the individual approach to complementary instruction in the focus of manipulative skills. Teachers that attempt to fully develop movement can look at using BKI principles as supplements to more object-movement instruction, more task repetition, and more time of intervention. An integrated approach can be a way of improving the efficiency of school-based physical education programmes (Kouli et al., 2024).

The positive aspects of the current research are that it is a randomized controlled study, made use of a validated evaluation measure (TGMD-2), and is conducted in a natural school environment, which adds to the ecological validity (Ulrich, 2000; Field et al., 2020). ANCOVA has also enhanced the analysis since it has considered the baseline performance differences (Cohen, 1988). However, there are some drawbacks that must be taken into consideration. The research was carried out in one school which can be a limitation to the fact that the results can be applied to other educational settings. Also, the 12 weeks of intervention time, although adequate to induce locomotor improvements, might have been inadequate to increase the similar results of gains in object-control skills. Future studies need to investigate more time-span of intervention, a larger extent of task specificity and combining complementary instructional models to enhance the overall development of skills (Kouli et al., 2024; Williams et al., 2021). The longitudinal sustainability of BKI-based gains and the connection of bodily-kinaesthetic intelligence to other educational areas, i.e. spatial or interpersonal intelligence can also be researched in future studies. The use of qualitative indicators, including teacher observations or student-participation measures, could be a way to have a closer look at the cognitive and affective mechanisms that underlie motor learning (Moreau, 2015; Light and Clarke, 2021).

In short, the above research results reveal that a 12-week bodily-kinaesthetic intelligence-based physical education programme can be useful in improving locomotor movement competency among early school-aged children. Though the change in object-control abilities was not so significant, the overall outcomes reveal the usefulness of developmentally appropriate and cognitively challenging instructional methods in the field of school-based physical education. The results can be added to the body of knowledge on the optimization of physical education programs to prevent the development of underdeveloped movement skills and development of poor movement literacy (Bailey, 2020; Bremer and Cairney, 2018).

## **CONCLUSIONS**

The current research paper discussed the impact of a 12-week bodily-kinaesthetic intelligence (BKI)-based physical education programme about basic movement skills among early school-aged children. The results show that the intervention had statistically significant and educationally significant positive changes over locomotor skills relative to conventional physical education. Conversely, object-control skills failed to exhibit within-group improvement although small between-group differences were noted when baseline performances are factored in. This evidence shows that BKI-based teaching is especially useful to improve the locomotor movement competency of the early childhood period in human development when the initial motor patterns are in a high degree of responsiveness to organized and mentally-involving practice. The

observed differences between the domains of skills emphasize the necessity of the domain-based teaching focus in drawing up school-based programmes of physical education. Practically speaking, the programme based on the BKI may be introduced into the usual schedule of schools without the additional equipment and can be a useful pedagogical strategy to enhancing locomotor competence in mixed educational establishments. The longest intervention length, higher specificity of object-control skills, and the sustainability of any improvements in the body movements in the long run should be examined in future to contribute to the development of the whole physical literacy.

## **AUTHOR CONTRIBUTIONS**

Both authors have contributed equally to the following sections: study design, data collection, statistical analysis, manuscript preparation, funds collection.

## **SUPPORTING AGENCIES**

No funding agencies were reported by the authors.

## **DISCLOSURE STATEMENT**

No potential conflict of interest was reported by the authors.

## **ETHICAL APPROVAL**

The research received the approval of the Institutional Human Ethics Committee, Hindustan Institute of Technology and Science, Chennai (Ref: HITS/PE-2025-03). The procedures were compliant with the 2013 Declaration of Helsinki. The informed consent of the parents was taken.

## **DATA AVAILABILITY STATEMENT**

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

## **AI USAGE DECLARATION**

AI tools were used solely for language editing and formatting. All research design, data analysis, interpretation, and conclusions were performed by the authors.

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