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Physical activity-english language for all: educational research in preschool for a culture of difference and diversity

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Abstract

Aim. This experimental study examined the effect of integrating physical activity with English language instruction in preschool with three-year-old students. The project followed the principles of Universal Design for Learning (UDL), an approach that includes students with disabilities, ensuring equal opportunities for success across the entire class group.
Material and method. The study involved two Italian preschools: My School in Civitanova Marche (MC) and Molini School in Molini di Tenna (FM). The children were divided into an experimental group (N=12) and a control group (N=13). The experimental group participated in an English teaching program based on a body-engagement methodology, while the control group followed a traditional program. Language and motor skills were assessed using the Peabody Picture Vocabulary Test (PPVT) and the Test of Gross Motor Development (TGM) before and after the intervention.
Results. The results indicated that mean scores for language and motor skills in the experimental group were significantly higher than those in the control group following the intervention. In the TGM test for locomotor skills, the experimental group's scores increased from 7.25 to 15.08, compared to the control group's smaller improvement from 7.69 to 10.69 ($F(23,1) = 13.65$, $p = .001$). For object control skills, the experimental group improved from 3.50 to 8.42, while the control group showed a more modest increase from 4.62 to 5.77 ($F(23,1) = 19.80$, $p = .000$). Similarly, the PPVT test demonstrated a significant improvement in the experimental group (56.17 to 83.50), with no meaningful change in the control group (52.77 to 54.70, $F(23,1) = 28.29$, $p = .000$). Mixed ANOVA confirmed the motor-based method's effectiveness in enhancing both language and motor skills.
Conclusion. The study highlights that integrating physical activity into foreign language teaching can promote more effective and engaging learning for three-year-old children, suggesting an inclusive educational approach. These findings support the use of innovative teaching methodologies based on movement to enhance language and cognitive skills in young learners.

Key words*: physical activity, exercise, disability, participation*

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Introduction

This research aims to explore the correlation between physical activity and foreign language learning in three-year-old children, considering this phase as critical for both linguistic and motor development (Howatt, 1984). The objectives of the study include evaluating the effect of physical activity on the acquisition of basic language skills, by analyzing the influence of physical activity on the cognitive abilities involved in language learning and exploring innovative teaching strategies based on physical activity to foster deeper and more lasting engagement in foreign language learning. This approach recognizes that traditional methods may not fully meet the specific learning needs of young children (Sisti, 2013).

Modern classrooms are increasingly "complex and pluralistic," requiring "rigorous instructional attention and care [...] to effectively support the teaching and learning processes of all students" (Gaspari, 2015, p.23). At this age, children are rapidly acquiring new skills. They are learning to think, reason, and move in increasingly complex ways (Piaget, 1973). Since their language abilities are still developing, they may not be able to fully comprehend or express themselves solely through words. Therefore, it is essential to utilize other communication methods such as gestures, images, and hands-on activities which can better support their overall learning and development (Montessori, 1949).

Physical activity is proposed as a key element for engaging children in playful and interactive activities in simultaneously stimulating physical, cognitive, and linguistic development. The potential benefits include increased active participation, facilitation of linguistic expression, experiential learning, and the use of multisensory connections which contribute to more integrated and meaningful learning (Latino, Fischietti, & Colella, 2020). Moreover, this approach is particularly advantageous for involving children who may have cognitive, motor, or behavioral disabilities by offering them opportunities for inclusive and personalized participation.

Materials and method

Data Collection Tools

For the experimental study, two Italian preschools were involved: the bilingual school "My School" in Civitanova Marche (MC) and the Molini preschool in Molini di Tenna (FM), part of the Da Vinci-Ungaretti Institute. The Zebra class, consisting of 12 children from Civitanova, formed the experimental group, while the Panda class from Molini, consisting of 13 children, served as the control group. Both groups underwent standardized tests on motor skills (TGM) and language proficiency (PPVT) at two stages: before and after the educational intervention.

The experimental group participated in an English language educational project once a week for approximately one and a half hours, integrating physical activity. The control group also followed an English language project, but focused primarily on oral and visual methods, conducted once a week for one hour.

Data were collected from a total of 25 children (9 females, 16 males) with an average age of 40 months at the time of the first data collection. A convenience sample was deemed sufficient for this exploratory study, comprising two classes from My School and the Da Vinci institutes, with socio-demographic characteristics that made the participants potentially more responsive to the intervention. To assess the effectiveness of the intervention, all 12 participants from the experimental section were non-randomly assigned to the experimental group (Gender: 2 Females, average age: 39 months). This class followed the experimental educational project. Another 13 children (Gender: 7 Females, average age: 41 months) from the Molini di Tenna school were assigned to a control group and followed a traditional educational program.

Measurements of socio-psycho-educational variables were conducted through self-report scales capable of capturing changes attributable to the effectiveness of the intervention. Data collection occurred twice: once before the educational intervention and again after the intervention for both groups of participants. The research design was mixed allowing for comparisons between the measurements taken at two different time points (Time 1 and Time 2) within the same group (within-subjects) to detect the magnitude of the effects attributable to the interventions as well as cross-group comparisons (between-subjects) between the experimental and control groups.

Standardized Language Test: PPVT

The Peabody Picture Vocabulary Test (PPVT) presents a series of colored images to which the participant must associate the words spoken by the examiner. The test is administered individually, and the score is based on the number of correct responses. Participants are not required to produce words or sentences but rather to select the word corresponding to the presented image by pointing at it. The raw scores were converted into Grade Score Values (GSV) to allow comparison following the procedure in the PPVT manual.

While the test is mostly used to assess passive vocabulary in the native language, several experimental studies report its use for evaluating second or foreign languages (Fenyvesi, Mikke, & Cadierno, 2018; Wooda & Schatschneiderb, 2019; Goriot, et al., 2021).

TGM Test

The Test of Gross Motor Development (TGM), developed by Ulrich in 1992, is designed to assess motor development levels in children with normative references for ages 3 to 10. Specifically, it evaluates 12 competencies divided into locomotor skills and object control skills:

Locomotor skills (TGM loc): running, galloping, hopping, jumping forward, standing long jump, leaping, sliding.

Object control skills (TGM obj): striking a ball with a tennis racket, bouncing a stationary ball, catching a ball thrown by hand, kicking a ball while running, throwing a ball with one hand.

Experimental Procedure

The educational project "I Can Fly" for the experimental group, following the principles of Universal Design for Learning (UDL) (Cottini, 2021), was carefully designed to be appropriate for all children, including those with disabilities, acknowledging that at this young age many children may not yet have formal diagnoses. The UDL approach facilitated the creation of an inclusive learning environment where all activities integrated language and motor skills in a cohesive manner. The ICF Children and Youth edition clarifies that "contextual factors (i.e., environmental and personal factors) interact with the individual in a health condition and determine the level and degree of functioning" (OMS, 2007, p.45).

A key aspect of the project was its playful nature, as "play often serves as a preparation for life, providing a safe way to practice skills. Therefore, it is crucial that the daily experiences of our children are characterized by spaces and physical places that allow them to express their inner world by laying the foundations for the individuals they will become" (Belfiore & Saraiello, 2024).

The project followed a methodology primarily based on Total Physical Respons (TPR) (Asher, 1969), integrating the motor skills of three-year-old children with language learning (Ladogana & Monacis, 2024). Additionally, the project employed the didactic atelier approach (Valentini & Santi, 2018) and the format method (Taeschner, 1992; Sisti, 2003), organizing activities such as mimed songs, nursery rhymes, games, motor courses, dramatization, experiential storytelling, reading and interpreting images all around a central theme: the story of Peter Pan. This integrative context allows children to instinctively identify with the protagonists thus making learning engaging and meaningful (Canevaro, 2007).

To evaluate the effectiveness of the intervention, a language test (Dunn & Dunn, 2007) and a motor skills test (Ulrich, 1992) were administered before and after the project. The results were compared with those of a control group that followed a traditional educational program primarily focused on oral skills without integrating the physical component. The entire project was conducted in an environment where the student was the main actor ensuring both care and realization.

Research in this area equips teachers with a variety of engaging strategies and techniques that can be applied to particular curriculum subjects. Inclusive teaching is not defined by specific content but is distinguished by its methodological focus and practical approach, shaping everyday instructional practices (Cottini, 2019).

Results

Data Analysis

For each variable, descriptive statistics were calculated, including mean, standard deviation, minimum-maximum scores, skewness, and kurtosis. Pearson's R correlation analyses was conducted to explore associations between variables. To test whether the intervention was more effective in the experimental group compared to the control group, mean scores of the dependent variables were compared using two-way mixed ANOVAs with repeated measures. This analysis involved a two-level within-subjects factor (time 1, pre-intervention, and time 2, post-intervention) and a between-subjects factor (intervention group vs. control group).

Descriptive Statistical Analysis

Preliminary reliability analyses (Cronbach's alpha) of the instruments used revealed adequate internal consistency for the TGM locomotor skills subscale (α at time 1 = .66; α at time 2 = .83), while the reliability indices for the TGM object control subscale were found to be poor to mediocre (α at time 1 = .29; α at time 2 = .52).

Descriptive statistics are reported in Table 1. Skewness and kurtosis values fall within the +2 / -2 range, indicating that the scores approximate a normal distribution. Figures 1, 2, and 3 graphically represent the comparisons of means. A preliminary review of the descriptive data shows that the mean scores of all variables indicative of the main intervention's effectiveness (TGM locomotor skills, TGM object control, and PPVT GSV) are higher in the experimental group at the post-intervention measurement (time 2).

Tabel 1. Descriptive statistics

		Media	*Standard Deviation*	*Range*	*Skewness*	*Kurtosis*
TGM loc Experimental Group	Time 1	7.25	3.02	2 - 12	.02	-.76
	Time 2	15.08	5.98	4 - 23	-.70	-.33
Control Group	Time 1	7.69	3.01	4 - 13	.35	-1.27
	Time 2	10.69	3.71	6 - 17	.40	-1.02
TGM obj Experimental Group	Time 1	3.50	1.45	1 - 6	.43	.39
	Time 2	8.42	1.83	5 - 11	-.32	-.25
Control Group	Time 1	4.62	1.26	2 - 7	-.01	.84
	Time 2	5.77	2.20	2 - 10	.46	.08
PPVT GSV Experimental Group	Time 1	56.17	16.94	37-76	-.09	-1.47
	Time 2	83.50	16.96	54 - 107	-.37	-.46
Control Group	Time 1	52.77	13.23	37 - 84	1.24	1.12
	Time 2	54.70	17.41	26- 91	.46	.30

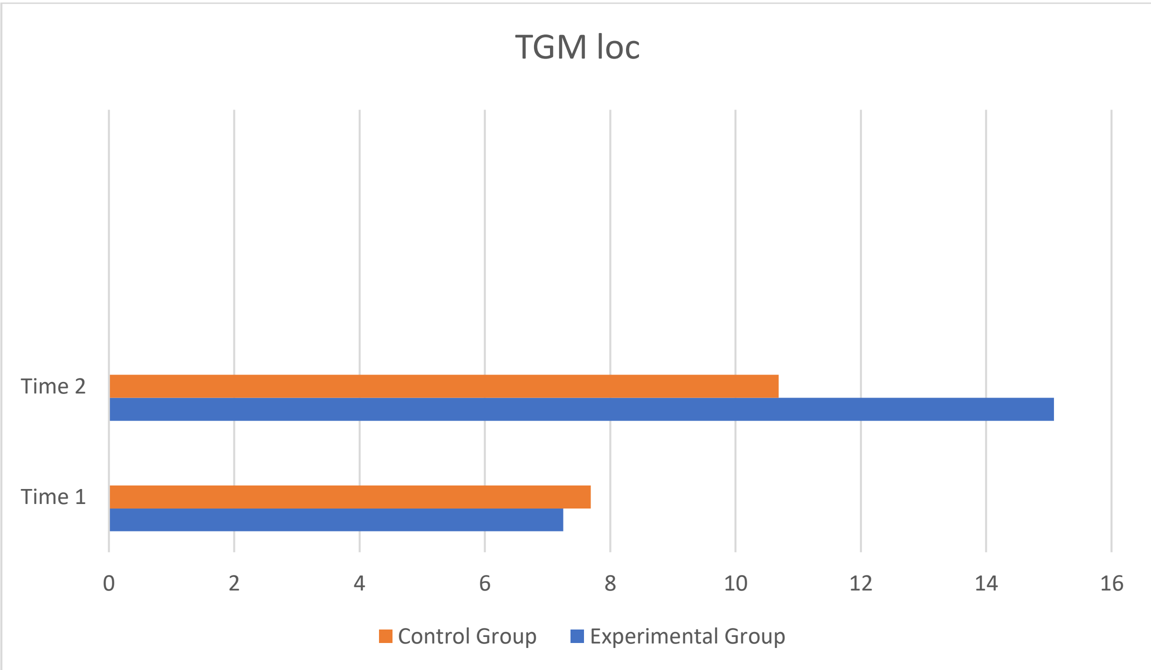

***Figure 1**. Comparison of mean scores for the TGM loc (locomotor skills)*

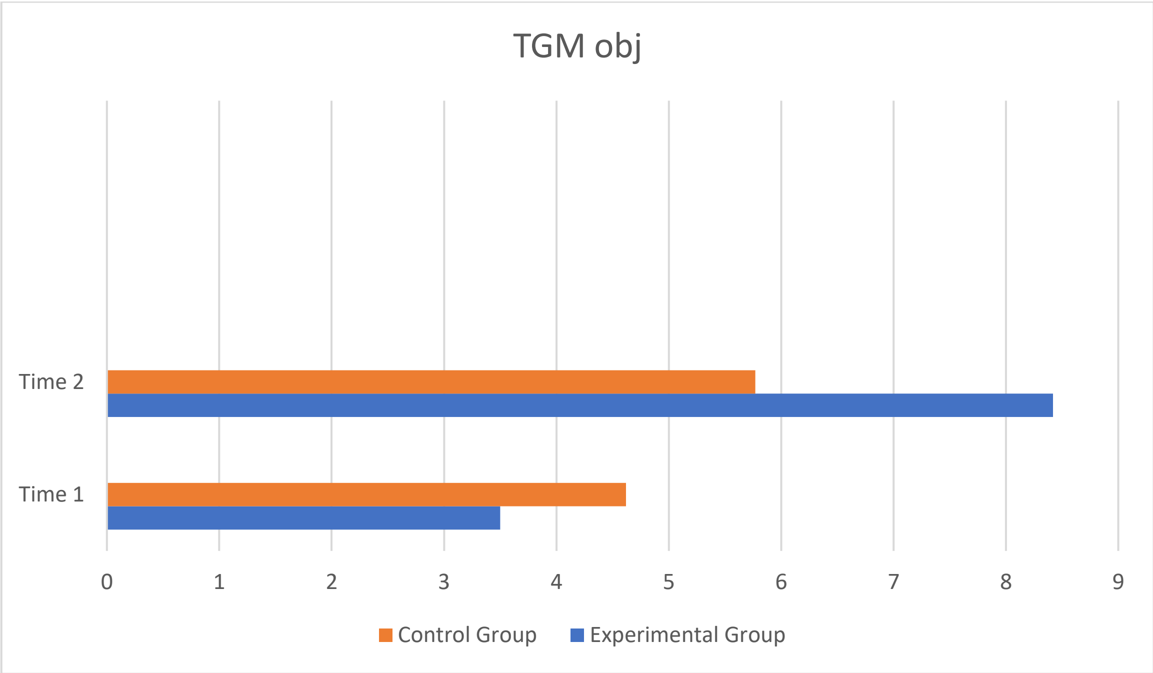

Figure 2. *Comparison of mean scores for the TGM obj (object control)*

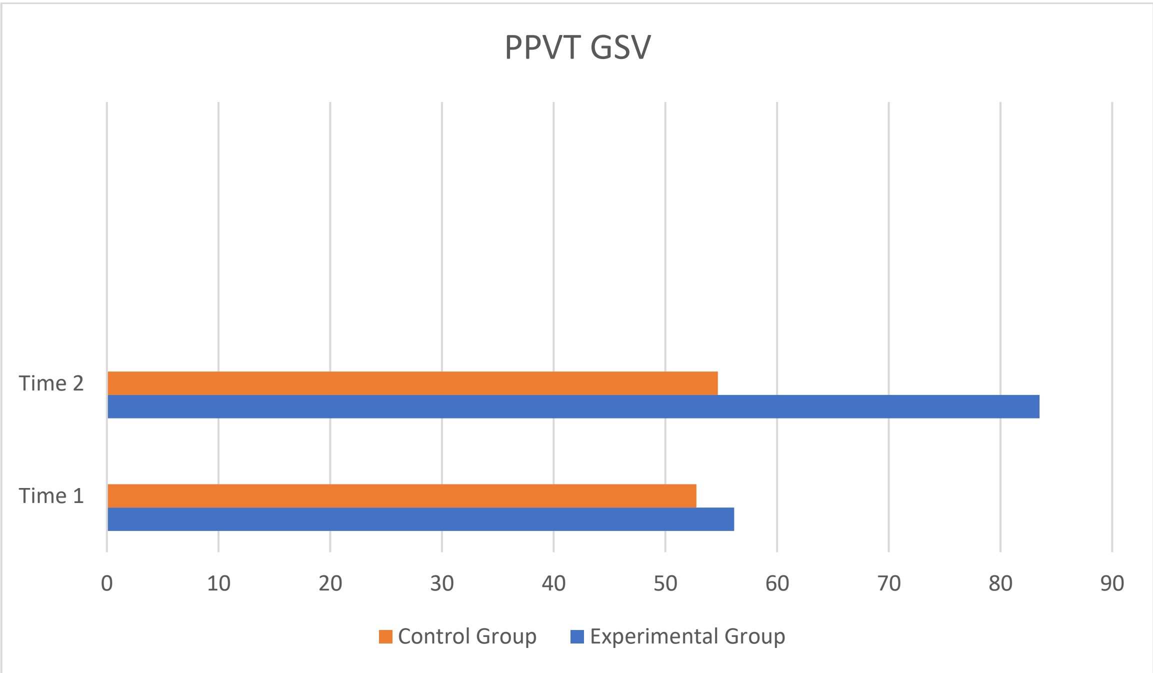

Figure 3. *Comparison of mean scores for the PPVT GSV*

Correlation Analysis

The Pearson correlations divided by the experimental and control groups, are reported in Tables 2 and 3.

Table 2: Correlation Analysis (Experimental Group)

Correlations

		TGM loc_t1	TGM loc_t2	TGM ogg_t1	TGM ogg_t2	PPVT GSV t1	PPVT GSV t2
TGM loc_t1	Pearson Correlation	1	,689*	-0,219	0,160	0,431	,603*
	Sig. (two-tailed)		0,013	0,495	0,619	0,161	0,038
TGM loc_t2	Pearson Correlation	,689*	1	-0,542	,694*	0,305	0,484
	Sig. (two-tailed)	0,013		0,069	0,012	0,335	0,111
TGM ogg_t1	Pearson Correlation	-0,219	-0,542	1	-0,429	-0,519	-0,441
	Sig. (two-tailed)	0,495	0,069		0,164	0,084	0,151
TGM ogg_t2	Pearson Correlation	0,160	,694*	-0,429	1	-0,038	0,198
	Sig. (two-tailed)	0,619	0,012	0,164		0,906	0,538
PPVT GSV t1	Pearson Correlation	0,431	0,305	-0,519	-0,038	1	0,507
	Sig. (two-tailed)	0,161	0,335	0,084	0,906		0,093
PPVT GSV t2	Pearson Correlation	,603*	0,484	-0,441	0,198	0,507	1
	Sig. (two-tailed)	0,038	0,111	0,151	0,538	0,093	

*. Correlation is significant at the 0.05 level (two-tailed).

Table 3: Correlation Analysis (Control Group)

Correlations

		TGM loc_t1	TGM loc_t2	TGM ogg_t1	TGM ogg_t2	PPVT GSV t1	PPVT GSV t2
TGM loc_t1	Pearson Correlation	1	,925**	0,296	0,302	-0,075	-0,099
	Sig. (two-tailed)		0,000	0,327	0,315	0,807	0,748
TGM loc_t2	Pearson Correlation	,925**	1	0,401	0,450	-0,081	-0,149
	Sig. (two-tailed)	0,000		0,175	0,123	0,791	0,627
TGM ogg_t1	Pearson Correlation	0,296	0,401	1	,895**	0,239	0,381
	Sig. (two-tailed)	0,327	0,175		0,000	0,432	0,198
TGM ogg_t2	Pearson Correlation	0,302	0,450	,895**	1	-0,008	0,133
	Sig. (two-tailed)	0,315	0,123	0,000		0,980	0,666
PPVT GSV t1	Pearson Correlation	-0,075	-0,081	0,239	-0,008	1	,930**
	Sig. (two-tailed)	0,807	0,791	0,432	0,980		0,000

PPVT GSV t2	Pearson Correlation	-0,099	-0,149	0,381	0,133	,930**	1
	Sig. (two-tailed)	0,748	0,627	0,198	0,666	0,000	

**. Correlation is significant at the 0.01 level (two-tailed).

The Pearson correlation analysis reported in Tables 2 and 3 reveal significant ($p < .05$) positive correlations between TGM loc (Time 1) and TGM loc (Time 2) in both the experimental and control groups, indicating a reasonable stability of the measure. Regarding the TGM obj dimension, significant and positive correlations are found between the two measurements at Time 1 and Time 2, but only in the control group. A similar effect is observed for the PPVT GSV dimension where the correlation between the two time points is significant and positive only for the control group, while it is nearly significant ($p < .05$) for the intervention group. Before proceeding with the analysis of variance, Levene's test was performed to verify the null hypothesis of equality of variance between the groups for all dependent variables being studied. In all cases, the test was not significant ($p > .05$), indicating that the assumption of homoscedasticity is met.

Regarding differences in TGM loc scores, the mixed repeated measures analysis of variance showed that the main effect of time (within subjects) on the scale scores is significant for both the experimental group [$F(23, 1) = 68.94$, $p = .000$] and the control group [$F(23, 1) = 10.95$, $p = .003$], indicating that the increase in TGM loc scores between the two assessments is statistically significant in both groups. The p-value indicates the probability that the results are due to chance. In both groups, the p-value is very low ($p = .000$ for the experimental group and $p = .003$ for the control group), suggesting that it is highly unlikely that the observed results are due to chance.

The main effect of the group factor between subjects (this refers to how scores differ between the experimental and control groups), was not significant [$F(23, 1) = .13$, $p = .717$] at Time 1 (pre-test), whereas it was significant at Time 2 (post-test) [$F(23, 1) = 4.96$, $p = .034$], showing that the mean TGM loc scores between the two groups did not differ before the intervention, but differed significantly in the post-intervention assessment. In short, at the beginning of the study, TGM loc scores did not differ between the groups, but after the intervention there was a significant difference in scores between the experimental and control groups.

Finally, the interaction of the "time" and "group" factors was significant [$F(23, 1) = 13.65$, $p = .001$], indicating that the increase in TGM loc scores between the first and second assessments depend on the group: the increase is greater in the experimental group compared to the control group (Figure 4).

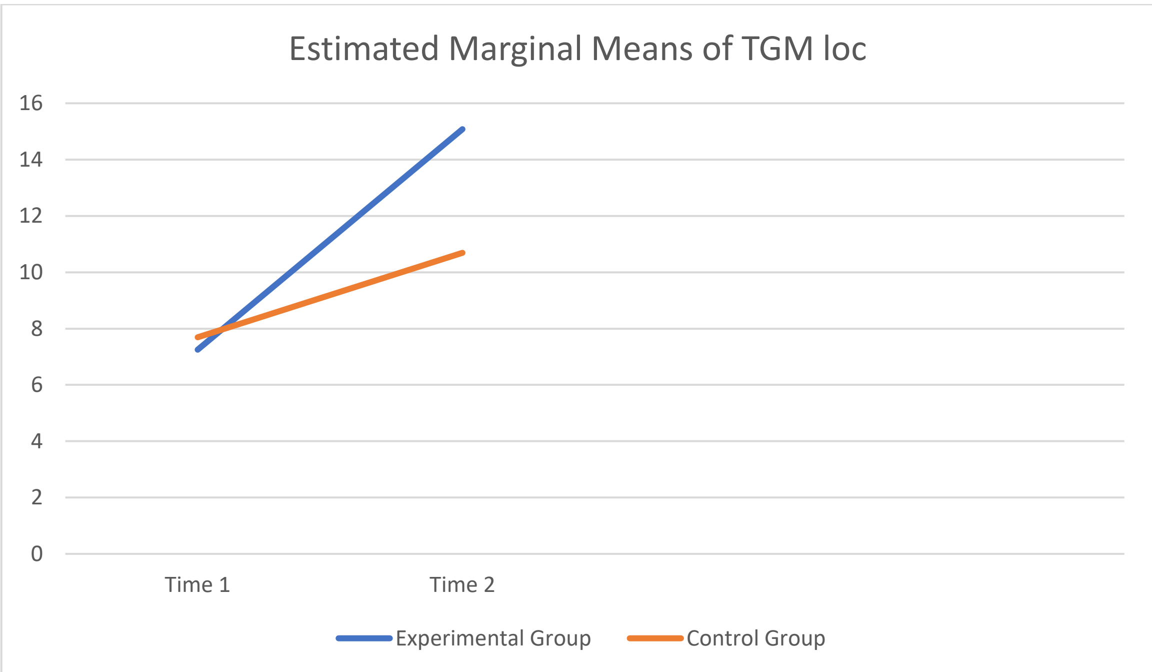

Figure 4. *Graphical Representation of the Interaction Between the "Time" and "Group" Factors in the Analysis of Differences in Mean TGM loc Scores*

Analyzing the differences in the TGM_obj variable scores, the repeated measures mixed ANOVA revealed that the increase over time (within subjects) in the scale scores was significant for the experimental group [F(23, 1) = 65.02, p = .000], but not significant for the control group [F(23, 1) = 3.88, p = .061]. This finding indicates that, as expected, only the experimental group showed an increase in TGM_obj scores. Regarding the between-subjects comparison at time 1, the control group had marginally higher mean TGM_obj scores compared to the experimental group, approaching statistical significance [F(23, 1) = 4.24, p = .051]. The mean scores also differed significantly in the between-group comparison at time 2 [F(23, 1) = 10.56, p = .004], in favor of the experimental group. The interaction effect between "time" and "group" was significant [F(23, 1) = 19.80, p = .000], indicating that the increase in TGM_obj scores between the first and second measurements depended on the group with a greater increase in the experimental group compared to the control group (Figure 5).

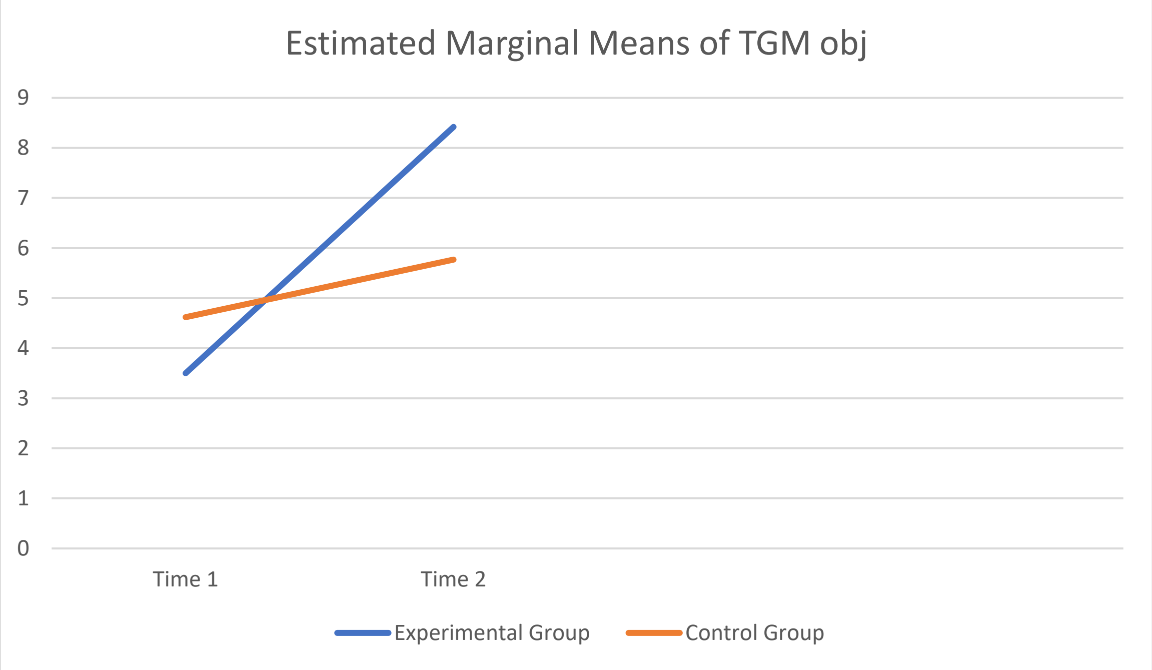

Figure 5. Graphical Representation of the Interaction Between the "Time" and "Group" Factors in the Analysis of Differences in Mean TGM obj Scores

Finally, regarding the scores of the PPVT GSV variable, the repeated measures ANOVA with a mixed model revealed that the effect of the time factor on the average scores (within-subjects) is significant for the intervention group [F(23, 1) = 62.95, p = .00] but not for the control group [F(23, 1) = .34, p = .567]. This analysis indicates that the mean increase in PPVT GSV scores between the two longitudinal administrations is statistically significant in the intervention group.

Between-group comparisons showed that, at time 1, there were no significant differences between the experimental group and the control group [F(23, 1) = .39, p = .54]. However, at time 2, as expected, the PPVT GSV scores differed significantly between the two groups [F(23, 1) = 17.52, p = .00]. The interaction between the "time" and "group" factors is significant [F(23, 1) = 28.29, p = .000], indicating that the increase in PPVT GSV scores from the first to the second measurement depends on the group: the increase is greater in the experimental group compared to the control group as illustrated in Figure 6.

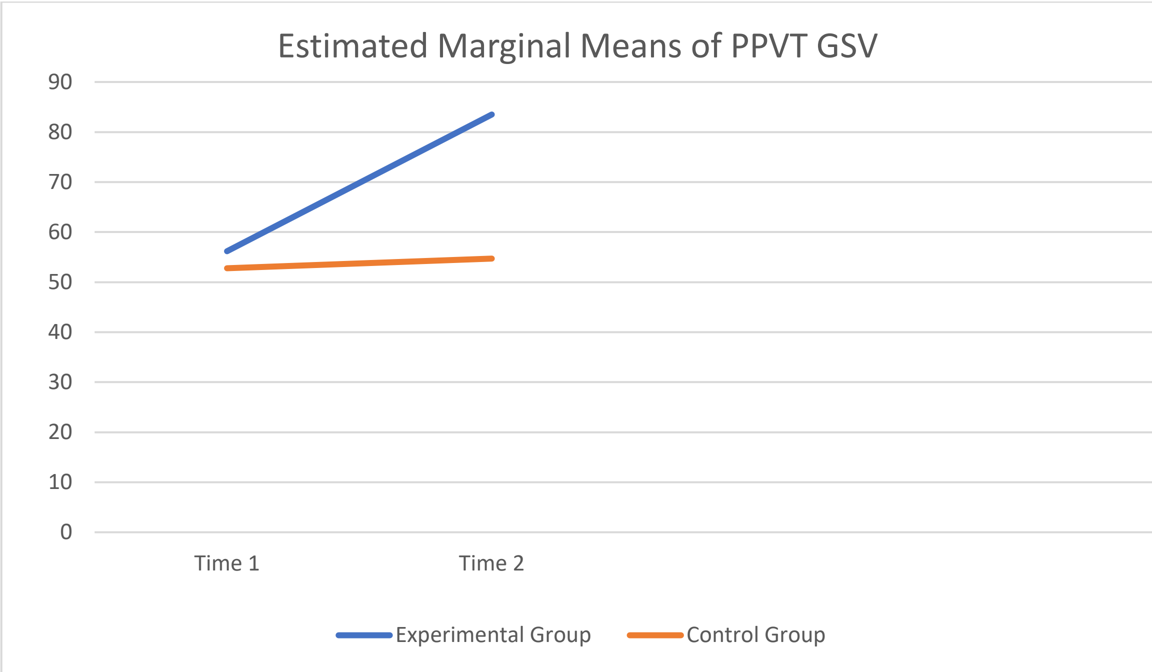

Figure 6*. Graphical Representation of the Interaction Between the "Time" and "Group" Factors in the Analysis of Differences in Mean PPVT GSV Scores*

Interpretation of Results

The results suggest that the educational project "I Can Fly", implemented in the Zebras class at Civitanova My School, was more effective in enhancing locomotor skills (TGM loc), object manipulation skills (TGM obj), and passive English vocabulary (PPVT GSV) compared to the control educational intervention in the Pandas class at Molini School. Specifically, the mean scores for all variables were significantly higher in the experimental group than in the control group at post-test (Time 2). Notably, the time-based increase in scores was greater in the group that followed the "I Can Fly" project which utilized a motor-based approach compared to the control group that engaged in an oral-based educational approach.

These results suggest, with considerable confidence, that the motor-based educational project had a particularly positive impact on the children's development within the experimental group to a greater extent compared to the maturation effect observed in the control group which was attributable to an alternative educational intervention.

The observation-listening methodology, applied in the play-motor atelier with the child's moving body as the focal point, allowed for monitoring the prerequisites for proper school integration and possible trajectories for the development of motor laboratories for older students. This approach addresses the theme of human differences and inclusive processes. The challenges and opportunities for promoting consistent best practices necessitate the integration of narrative skills into early childhood education curricula. In our case, the use of stories such as Peter Pan, activates various complex cognitive processes fostering inclusive and sustainable learning.
"Managing the classroom in inclusive education means ensuring that every student receives appropriate educational attention to meet their individual needs, promoting a productive learning environment, especially for those with sensory, psychological, and cognitive-behavioral difficulties" (Gaspari, 2014, p.54).

In essence, the results provide strong evidence that the motor-based educational project had a significant and positive influence on the children's development, and this effect appears to be more pronounced compared to the impact of the oral-based educational approach in the control group.

Discussion

Despite these findings, the results should be interpreted with caution. The non-probabilistic sampling method and non-random assignment to experimental conditions did not ensure that the two groups were matched and thus comparable in terms of demographic and socio-psychological characteristics. Consequently, the research design did not rule out a potential selection bias, as participants may have been assigned to the experimental or control group due to uncontrolled factors. Thus, it is not possible to exclude that some of the maturation effects might be attributed to interactions with unconsidered variables. Additionally, the intrinsic characteristics of the participants (e.g., entire classes) and the limited sample size restrict the generalizability of the results to other contexts. However, the study provides robust preliminary evidence regarding the effectiveness of the motor intervention which should be confirmed in future research conducted in diverse educational settings.

A key aspect to emphasize and reflect upon is the importance of a holistic view of learning which involves multiple disciplines where each contribute specific knowledge and skills. When effectively integrated by a teacher with a unified vision of knowledge, this approach adapts to the individual characteristics of each student, transforming teaching into inclusive learning (Emili & Pascoletti, 2021, p.21). Designing educational pathways that are inclusive and adapted to students' differences and diversity should become a standard part of school practices. Inclusion must be a foundational principle of pedagogy, not an addition or an exception, but a natural element of every educational proposal. 'Specialty' and 'normality' mutually enrich each other within shared spaces and inclusive contexts (Cottini, 2017).
A school for all: necessarily, professionally, and simply.

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