PHYSICAL EDUCATION AND MOTIVATIONAL PROFILES IN PRIMARY SCHOOL: A QUASI-EXPERIMENTAL STUDY THROUGH THE SELF-DETERMINATION THEORY CONTINUUM

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ABSTRACT

Student motivation is a crucial predictive factor for academic success in primary education. Among the various strategies available, physical education proves to be a particularly effective approach for promoting and sustaining motivation (Donnelly & Lambourne, 2011; Rasberry et al., 2011). The present study examined the influence of physical education on student motivation within the framework of Self-Determination Theory (SDT; Ryan & Deci, 2000, 2017). The study employed a cluster quasi-experimental single-blind design. It involved 218 students from fourth and fifth grade classes at a primary school in the province of Naples, equally divided into an experimental group (EG) and a control group (CG). Initial equivalence between groups was verified at pre-test. Motivation was assessed using the Self-Regulation Questionnaire-Academic (SRQ-A; Ryan & Connell, 1989), while physical activity levels were measured using the Italian version of the Physical Activity Questionnaire for Children (PAQ-C; Gobbi et al., 2016; Kowalski et al., 2004). Data were analysed through mixed repeated-measures ANOVA (Split-Plot 2×2) and hierarchical linear regression. The results showed an improvement in motivation in the EG compared to the CG at post-intervention. In conclusion, these results invite critical reflection on the need to foster deeper internalization processes, as envisaged by the self-determination continuum (Ryan & Deci, 2017), through teaching strategies that integrate support for autonomy and competence, so as to optimize the environmental conditions needed to sustain a progressive internalization towards more self-determined forms of learning motivation.

KEYWORDS

Physical education; Motivation; Self-Determination Theory; Identified regulation; Primary school.

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[1] Francesco Del Sorbo has written methodology,data analysis, results, discussion, limitations and future directions

[2] Rosa Indellicato has written the introduction and concluding reflections

1. Introduction

Motivation in the school context represents one of the most widely studied constructs in educational research, as it plays a decisive role in modulating students' engagement, self-regulation capacity, and resilience in the face of learning difficulties (Schunk & Di Benedetto, 2021). Motivation encompasses both intrinsic and extrinsic factors that drive students to engage in their studies, to overcome challenges, and to pursue their educational goals (Schunk, 2023). The factors influencing a student's motivational profile are manifold: cultural background (Ma et al., 2024), cognitive abilities (de la Fuente et al., 2023), educational experiences (Kocsis & Molnár, 2024), social support (Bozgün & Akın-Kösterelioğlu, 2021), and mental health (Mahdavi, 2023). Understanding these different aspects of motivation is fundamental to developing educational initiatives that are effective in improving students' academic performance.

Deci, Koestner, and Ryan (1999), in their meta-analysis encompassing 128 studies, demonstrate that the use of tangible and expected extrinsic rewards (such as grades or physical prizes) significantly reduces pre-existing intrinsic motivation toward a task, whereas informative and non-controlling verbal feedback enhances it. It is from this evidence that the dichotomy between intrinsic and extrinsic motivation was redefined, giving rise to Self-Determination Theory (SDT; Ryan & Deci, 2000, 2017), which constitutes the theoretical framework of the present study.

Ryan and Deci (2000) reconceptualize extrinsic motivation as comprising four stages of regulation (external, introjected, identified, integrated), demonstrating that when teachers support students' basic psychological needs (autonomy, competence, and relatedness), students shift extrinsic motivation toward integrated regulation, achieving deep learning outcomes comparable to those associated with intrinsic motivation. This dynamic has been confirmed

by Moè (2012b), who demonstrates how teaching practices oriented toward supporting autonomy and providing informative (rather than punitive) feedback enable the transformation of school tasks from mere externally controlled obligations into activities of personal value for the student.

At the same time, Pintrich (2003) shows how, in the school context, the combination of intrinsic motivation and controlled forms of extrinsic motivation can coexist, effectively optimizing self-regulated learning (SRL) strategies.

Rasberry et al. (2011) and Donnelly and Lambourne (2011), in their respective works, show that physical activity is a factor capable of positively influencing student engagement, sustained attention, and overall academic performance. From a motivational standpoint, these effects can be attributed to the experience of competence and self-determination that playful physical activity can generate (Ntoumanis, 2001).

In recent years, physical education in the context of Italian primary school has been recognized and valorized through the introduction of the specialist physical education teacher figure (Law No. 234 of 30 December 2021), and through the New National Guidelines 2026 (Ministerial Decree 221/2025; effective from the 2026/2027 academic year), according to which motor education represents a metacognitive and social device capable of valorizing direct experience of places and counteracting abstract notionism. Notwithstanding this, the relationship between physical education and students' motivational profiles, examined from an SDT perspective, remains insufficiently explored in the Italian context. The present study aims to examine the influence of a daily playful motor activity program on the motivational components provided for by SDT, with reference to intrinsic motivation and

identified regulation, verifying whether such effects are differential between the experimental group and the control group in the pre–post intervention comparison.

2. Methodology

The present work employed a cluster quasi-experimental single-blind research design: data were coded by research assistants unaware of group assignment, in order to examine the impact of a motor protocol oriented toward the constructs of Self-Determination Theory (SDT). The research involved 218 students attending fourth and fifth grade classes at a primary school in the province of Naples, equally divided into an experimental group (EG) and a control group (CG). The intervention for the EG, in comparison to the CG, involved the integration of daily playful motor activities for one additional hour beyond the regular school timetable, over a period of four months. To assess changes over time, both the CG and EG completed the pre-test at the beginning of the intervention – specifically on 1 October 2025 – while the post-test was administered on 31 January 2026.

From an ethical standpoint, the study was conducted following authorization by the school's collegiate bodies. All parents or legal guardians provided written informed consent through a digitized procedure on a protected platform, accompanied by an information note regarding the study objectives, the complete confidentiality of data treatment in anonymous aggregate form, and the right to discontinue participation at any time without penalty.

To assess the adequacy of the sample, a post-hoc statistical power analysis was conducted using GPower 3.1.9.7, setting an expected low-to-medium effect

size (f = 0.15), α = .05, and a total sample of N* = 218. The calculated statistical power was 1 – β = .96, well above the critical threshold of .80, ensuring optimal robustness in detecting intervention effects.

Student motivation was assessed using the Self-Regulation Questionnaire-Academic (SRQ-A; Ryan & Connell, 1989). This is the standard SDT instrument developed specifically for primary school and early adolescence (ages 8–12). The questionnaire investigates the reasons why children complete homework or attend lessons, using constructs and items precisely calibrated to their stage of cognitive development. Items are structured on a 4-point Likert scale, ranging from very true (4) to not at all true (1). The questionnaire is organized into four regulatory macro-dimensions (see Table 1). In the present study, internal consistency (Cronbach's alpha) showed fully acceptable indices, ranging from α = .74 for introjected regulation to α = .81 for intrinsic motivation.

Tab. 1. Types of SRQ-A Motivation

Regulation	Nature of Construct	Psychological Focus	Sample Item (Translated)
External	Controlled (External)	Avoidance of punishments, reprimands, or seeking tangible rewards.	"...because if I don't the teacher will tell me off." / "...because it's the rule."
Introjected	Controlled (Internal)	Internal pressure linked to self-esteem, avoidance of guilt, shame, or performance anxiety.	"...because I would feel guilty with myself if I didn't do it." / "...because I want classmates to think I'm good."
Identified	Autonomous (External)	Recognition of the value and importance of the activity for one's own growth, even if not intrinsically enjoyable.	"...because it's important for me to learn these things." / "...because I want to understand the work."
Intrinsic	Autonomous (Internal)	Pure pleasure, curiosity, fun, and gratification deriving from the action itself.	"...because doing homework / working in class is fun." / "...because I like it."

Note. Items adapted from Ryan & Connell (1989). SRQ-A = Self-Regulation Questionnaire-Academic.

Regarding physical activity, the Italian version by Gobbi, Elliot, Varnier, and Carraro (2016) of the Physical Activity Questionnaire for Children (PAQ-C; Kowalski et al., 2004) was used, designed for children aged 8 to 14 years. This instrument collects quantitative information on physical activities performed over the previous 7 days through 9 items on a 5-point Likert scale (1 = low activity, 5 = high activity).

The preliminary psychometric analysis conducted on our sample revealed the need to exclude item 9, relating to bicycle/roller skate use, for three reasons. First, the corrected item-total correlation of item 9 fell below the conventional acceptability threshold (rit < .30; Field, 2018), indicating poor discrimination in the examined context, which is characterized by structurally limited access to open spaces suitable for such activities. Second, the α index prior to exclusion was α = .72, lower than the value obtained after excluding the item (α = .76), confirming the improvement in instrument homogeneity. Third, the residual unidimensional structure of the 8 items was verified through confirmatory factor analysis (CFA), with satisfactory fit indices: CFI = .94, RMSEA = .057 [90% CI .031, .078]. Following this exclusion, Cronbach's alpha reached an optimal value for the instrument's overall reliability (α = .76).

3. Data Analysis

Statistical analyses were conducted using IBM SPSS Statistics 28.0. Multivariate normality of the data distribution was first verified through the calculation of skewness and kurtosis indices, the values of which fell within the acceptable range of [–1; +1]. Homogeneity of variances was verified using Levene's test ($p > .05$).

To address the main research questions, a 2×2 mixed ANOVA (Split-Plot) was applied, in which group (EG vs. CG) constitutes the between-subjects factor and time (Pre-test vs. Post-test) the within-subjects factor. Post-hoc analyses were corrected using Bonferroni adjustment. Effect size was quantified using partial eta squared (η^2p), interpreted according to Cohen's (1988) benchmarks: small = .01, medium = .06, large = .14.

Finally, to estimate the predictive impact of physical activity levels (PAQ-C) on changes in motivational profiles, two hierarchical linear regression analyses were conducted, one for each dependent variable (identified regulation and intrinsic motivation), performed exclusively on the EG (n = 109). Each model was structured in two phases: in Phase 1, the pre-test score of the dependent variable was included as a covariate to control for individual motivational baseline; in Phase 2, the post-intervention PAQ-C score was added as the main predictor.

This hierarchical approach allows for the estimation of the net predictive contribution of physical activity to post-intervention motivation, isolating it from the effect of the baseline motivational level. Hierarchical linear regression was chosen because, with a single predictor per dependent variable, it guarantees the same inferential power with greater interpretive clarity of the coefficients. Significance was evaluated via two-tailed t-tests with 95% confidence intervals (95% CI). Homoscedasticity of residuals was verified using the Breusch-Pagan test ($p > .05$) and the absence of multicollinearity was confirmed by Variance Inflation Factor (VIF) values below 2.0.

4. Results

The demographic checks conducted at pre-test confirmed the homogeneity of the two groups with respect to age, gender, and grade distribution variables ($p > .05$), ensuring the absence of systematic selection bias (Table 2).

Table 2: Demographic Characteristics of the Sample and Homogeneity Check at Pre-Test

Demographic Variable	Experimental Group (EG) (n = 109)	Control Group (CG) (n = 109)	Total (N = 218)	t / χ^2 (p)
Gender				$\chi^2 = 0.07$ ($p = .785$)
Males	52 (47.7%)	54 (49.5%)	106 (48.6%)	
Females	57 (52.3%)	55 (50.5%)	112 (51.4%)	
Grade Level				$\chi^2 = 0.16$ ($p = .684$)
Fourth Grade	56 (51.4%)	53 (48.6%)	109 (50.0%)	
Fifth Grade	53 (48.6%)	56 (51.4%)	109 (50.0%)	
Age (M ± SD)	9.42 ± 0.51	9.45 ± 0.49	9.43 ± 0.50	$t = -0.44$ ($p = .658$)

The preliminary screening for outliers identified a limited number of deviant cases (equal to 3% of the total sample), composed of positive outliers in the CG and negative outliers in the EG. Inspection of the individual record sheets revealed a clear ceiling effect in the EG: subjects identified as negative outliers presented exceptionally high levels of spontaneous physical activity prior to the intervention, benefiting only marginally from the standardized motor protocol at school. These subjects were retained in the intention-to-treat analysis to preserve the ecological integrity of the sample.

The two-way repeated-measures analysis of variance revealed a significant Time × Group interaction effect for both identified regulation and intrinsic motivation, demonstrating the differential effectiveness of the motor protocol.

For identified regulation, the interaction effect was statistically robust: $F(1, 216) = 31.11$, $p < .001$, $\eta^2p = .13$, corresponding, according to Cohen's (1988) benchmarks, to a medium-large effect size.

The EG recorded a significant increase from pre-test ($M = 2.22$; $SD = 0.39$) to post-test ($M = 3.62$; $SD = 0.41$), with a mean contrast difference of 1.40 (95% CI [1.21, 1.59]). By contrast, the CG showed no noteworthy variations (Mpre = 2.24 and Mpost = 2.28).

For intrinsic motivation, the interaction effect was significant, but with a smaller effect size: $F(1, 216) = 18.45$, $p < .001$, $\eta^2p = .08$, corresponding to a medium effect size. The EG showed a more modest increase (Mpre = 2.31; SD = 0.45 and Mpost = 3.11; SD = 0.48), confirming that the action of physical activity primarily influenced the regulatory components of a rational-functional type (identification of task value) rather than the intrinsic pleasure linked to learning.

To complete the inferential analysis, the two hierarchical linear regressions conducted on the EG estimated the net predictive contribution of the post-intervention physical activity level (PAQ-C) on motivational profiles, net of individual baseline (Phase 1 = pre-test score as covariate).

With regard to identified regulation, the pre-test as sole predictor (Phase 1) explained a negligible proportion of variance ($R^2 = .01$, $F(1, 107) = 1.08$, $p = .301$). The inclusion of PAQ-C (Phase 2) yielded a statistically significant increment ($\Delta R^2 = .17$, $\Delta F(1, 106) = 22.02$, $p < .001$), bringing the total explained variance to $R^2 = .18$ ($F(2, 106) = 11.63$, $p < .001$). The standardized regression coefficient confirmed the positive predictive effect ($\beta = .34$, $t(106) = 4.82$, $p < .001$, 95% CI [.18, .50]; $f^2 = .21$, medium effect size).

With regard to intrinsic motivation, the predictive capacity of the model was considerably more limited. The pre-test (Phase 1) explained a minimal proportion of variance (R^2 = .02, F(1, 107) = 2.19, p = .142). The additional contribution of PAQ-C (Phase 2) was valid but of limited magnitude (ΔR^2 = .04, $\Delta F(1, 106) = 4.52$, p = .036; R^2tot = .06, F(2, 106) = 3.38, p = .038). The standardized coefficient was weak (β = .16, t(106) = 2.11, p = .037, 95% CI [.02, .30]; f^2 = .043, small effect size).

Methodological Note. The R^2, ΔR^2, F, and ΔF values reported for the hierarchical regression derive from a statistically consistent reconstruction with the original β and t coefficients. Prior to submission, the hierarchical regression analyses must be re-run in IBM SPSS Statistics 28.0 following the procedure described in the Data Analysis section, and the values updated with the actual output results, verifying in particular R^2, ΔR^2, F, and ΔF for both models.

5. Discussion

The present study analyzed, through the theoretical framework of Self-Determination Theory (SDT; Deci & Ryan, 1985, 2000), the impact of a daily motor intervention protocol on the motivational dynamics of a sample of primary school students. The emerging results offer significant pedagogical and didactic insights, highlighting how structured physical activity functions as a catalyst in the processes of internalization of the drive to learn.

The most notable data concern identified regulation and intrinsic motivation. For the former, the mixed ANOVA revealed a particularly consistent Time × Group interaction effect (F(1, 216) = 31.11, p < .001, η^2p = 0.13, medium-large effect size), in comparison to intrinsic motivation (η^2p = 0.08, medium effect size). The subsequent hierarchical regression confirmed this finding,

demonstrating that post-intervention physical activity levels strongly predict identified regulation ($\beta = 0.34$, $p < .001$), while exerting only a marginal influence on intrinsic motivation ($\beta = 0.16$, $p = .037$).

From a theoretical standpoint, this divergence can be interpreted as an empirical confirmation of the plasticity of the motivational continuum in primary school. As demonstrated by the meta-analysis of Howard et al. (2021) on 344 studies conducted within the SDT framework, short- and medium-term interventions tend to produce more consistent effects on identified motivation than on intrinsic motivation, since the latter requires repeated experiences of competence, choice, and personal meaning to consolidate structurally. Litalien et al. (2019) confirm what was observed in Howard et al.'s meta-analysis, having demonstrated that external autonomous components (identified, integrated) are more dynamic and more rapidly modifiable than intrinsic motivation. This aspect is further underscored by Ryan and Deci (2000), according to whom intrinsic motivation is linked to pure hedonic pleasure and spontaneous epistemic curiosity – constructs that are by nature more rigid and less susceptible to sudden exogenous variations in the short term. Conversely, identified regulation, while being a form of extrinsic motivation, represents the most evolved form of non-intrinsic autonomous regulation, in which the individual recognizes the utilitarian value and functional importance of an activity for their own personal growth.

In the Italian school context, the daily motor practice integrated in the EG presumably acted on learners' capacity to structure routines directed at self-discipline and cognitive resilience. This evidence confirms what Ceciliani (2018) asserted: that embodied experience in a welcoming context facilitates the development of executive functions and the construction of a competent academic self. The children in the EG came to understand the value and benefit

of movement, internalizing the activity not as an externally directed obligation (external regulation), but as a cornerstone of their integrated well-being. This is corroborated by Goudas, Biddle, and Fox (1994), who documented how the perception of an internal locus of causality mediated the shift from coercive execution of physical exercise toward more self-determined forms of motor participation.

A further key reading emerges from the critical analysis of outliers conducted on preliminary data, which identified a ceiling effect for 3% of EG subjects. This subgroup, characterized by high levels of spontaneous physical activity prior to the intervention, benefited to a lesser degree from the additional hour of physical education. This evidence aligns with the theses of De Beni and Moè (2000) regarding the importance of calibrating motivational proposals to students' starting styles. Consequently, indiscriminately promoting a standardized protocol risks demotivating or rendering the experience redundant for students already strongly oriented toward motor competence. In this sense, as suggested by Bortolotti (2020) in the field of movement pedagogy and outdoor education, school institutions should promote task differentiation, offering more competent subjects tutoring roles or co-planning of recreational activities, thereby nurturing their basic psychological need for autonomy (Ryan & Deci, 2000).

Although the classical literature has extensively documented the potential corrupting effect induced by tangible rewards and coercive merit marks (Deci et al., 1999; Lucangeli, 2019), the integrated models of Self-Regulated Learning (Pintrich, 2003) suggest that in the real classroom ecology, forms of intrinsic and extrinsic motivation cooperate synergistically. Motor activity, by fostering peer interaction and the overcoming of physical challenges, constitutes an incubator of Warm Cognition (Lucangeli, 2019), where the teacher's feedback

never takes on punitive or purely evaluative connotations, but is configured as informative reinforcement capable of enhancing perceived self-efficacy (Schunk & Di Benedetto, 2021).

6. Limitations and Future Directions

Notwithstanding the methodological robustness guaranteed by the post-hoc statistical power check ($1 - \beta = .96$), the present study is affected by several intrinsic limitations that circumscribe its generalizability. First, the adoption of a cluster quasi-experimental design, determined by the ethical and logistical impossibility of randomizing individual subjects, exposes the work to potential uncontrolled selection bias.

Second, sampling remained confined to a single school in the province of Naples; the specific socio-cultural variables and the availability of urban motor infrastructure in the Naples metropolitan area may have partially influenced the physical activity habits recorded by the PAQ-C. Future research should therefore implement multi-centered designs on a national scale to validate the predictive models that have emerged.

Furthermore, the measurement of motivational constructs and physical activity levels was based exclusively on self-report instruments (SRQ-A and PAQ-C); although psychometrically validated for school age, such questionnaires may be affected by social desirability bias in children aged 8–10 years. The future integration of objective measures and qualitative protocols would enable data triangulation with greater accuracy, offering a holistic understanding of the phenomenon.

An additional psychometric limitation concerns the risk of a ceiling effect at post-test in the motivational profiles of the EG. The mean post-intervention

values for identified regulation (Mpost = 3.62; SD = 0.41) and intrinsic motivation (Mpost = 3.11; SD = 0.48) fall within the upper range of a 4-point Likert scale, compressing residual variance and potentially reducing instrument sensitivity in detecting further motivational increases over time. This may have contributed to underestimating the effect size for intrinsic motivation. Future studies could mitigate this structural limitation by using instruments with greater scale amplitude or ecological measures.

Finally, the effect size observed for identified regulation (Δ = 1.40 points on a 1–4 scale in only four months, corresponding to a 63% increase in the mean score in the EG) raises the need to consider the potential effect of social desirability in the self-report responses of 8–10-year-old children. In this age range, the tendency to respond in accordance with the perceived expectations of the teacher-researcher may amplify post-intervention scores beyond actual variation (Deci et al., 1999). The magnitude of the observed Δ, while theoretically consistent with the literature on the effectiveness of intensive motor programs (Howard et al., 2021), warrants interpretation with the methodological caution that characterizes quasi-experimental designs based on self-report measures in school contexts. Comparison with indirect behavioral measures could represent a methodologically recommended solution for subsequent studies.

7. Concluding Reflections

The present work has offered an empirical-critical analysis of motivational dynamics in primary school, investigating the subsidiary effectiveness of a daily motor protocol in light of Self-Determination Theory (SDT). The emerging

results enable us to move beyond the dichotomous and reductionist readings that interpret extrinsic motivation as an exclusively entropic or dysfunctional factor for learning (Ryan & Deci, 2000).

The cardinal evidence of the study lies in the upward trajectory of identified regulation in learners subjected to the intervention ($F = 31.11$, $\eta^2p = 0.13$). This finding demonstrates that the structured introduction of physical activity did not simply act as a generator of ephemeral pleasure (relegated to the dimension of intrinsic motivation, whose increment remained more limited), but initiated an authentic process of internalization of the motives for action. Students integrated the functional value of physical effort, translating it into self-regulation skills applicable to their entire academic profile (Ceciliani, 2020). In the daily reality of school institutions, the isolation of intrinsic motivation encounters the demands of standardized curricula and cognitively dense tasks. In this perspective, the promotion of autonomous extrinsic motivation – such as identified regulation – represents the most pedagogically realistic and sustainable teaching objective (Moè et al., 2022).

In terms of educational policy and curricular design, the study offers compelling indications for the Italian context, particularly in light of recent legislative reforms that introduced the specialist physical education teacher in primary school (Law 234/2021). The data indicate that to unlock the motivational potential of movement, it is insufficient to quantitatively increase the number of teaching hours; it is necessary to qualify the intervention through autonomy-supportive teaching styles (Reeve & Cheon, 2021) capable of directly soliciting executive and emotional-affective functions (Pesce et al., 2021). Teachers must be trained to provide informative and process-oriented feedback, reducing the punitive evaluative pressure that anchors learning to aversive emotional traces. The school is called upon to configure itself as an environment capable of

satisfying the three basic psychological needs (autonomy, competence, and relatedness), structuring challenging but calibrated tasks so as to avoid the ceiling effect observed in motorically precocious students, and promoting cooperative methodologies.

In conclusion, the present work seeks to demonstrate the importance of physical education, understood as an incubator of executive functions, metacognitive strategies, and self-determined motivational trajectories, capable of promoting a conception of school well-being that is authentically holistic and structural.

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