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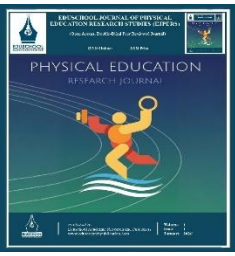

Direct Versus Inquiry-Based Teaching on Engagement And Physical Literacy

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Abstract

This study presents a comparative analysis of direct instruction (DI) and inquiry-based teaching (IBT) models and their respective effects on student engagement and physical literacy development in secondary school physical education (PE). Using a randomized crossover design, 210 students (ages 13–16) from three secondary schools experienced both instructional models across two 8-week units. Student engagement was measured using the Student Engagement Instrument for Physical Education (SEI-PE), systematic observation of academic learning time in PE (ALT-PE), and accelerometry. Physical literacy was assessed through a composite measure incorporating physical competence, knowledge and understanding, motivation and confidence, and daily physical activity behavior. Results revealed that IBT produced significantly higher cognitive engagement ($p < .001$, $d = 0.82$) and affective engagement ($p < .01$, $d = 0.61$), while DI yielded greater motor engagement time ($p < .05$, $d = 0.44$). Physical literacy composite scores favored the IBT condition ($p < .01$, $d = 0.57$), primarily driven by improvements in knowledge, motivation, and confidence domains. The findings suggest that both models have complementary strengths, and an integrated pedagogical approach may best serve physical literacy development.

Keywords: - Direct Instruction, Inquiry-Based Teaching, Student Engagement, Physical Literacy, Physical Education Pedagogy

I. INTRODUCTION

The debate between teacher-centered and student-centered pedagogies has long been central to physical education discourse (Mosston & Ashworth, 2008). Direct instruction (DI), characterized by explicit teacher demonstration, structured practice sequences, and systematic feedback, has traditionally dominated PE teaching due to its efficiency in transmitting motor skills and managing large groups (Rink, 2020). Conversely, inquiry-based teaching (IBT), which encompasses guided discovery, problem-solving, and divergent production approaches, has gained increasing attention for its potential to develop critical thinking, creativity, and deeper understanding of movement concepts (Light, 2013).

The emergence of physical literacy as a holistic educational outcome has intensified this debate. Physical literacy, defined as the motivation, confidence, physical competence, knowledge, and understanding to value and take responsibility for engagement in physical activities for life (Whitehead, 2019), demands pedagogical approaches that extend beyond mere skill acquisition. While DI may efficiently develop physical competence, IBT may be better positioned to cultivate the affective and cognitive dimensions of physical literacy (Dudley, 2015).

Student engagement, a multidimensional construct encompassing behavioral, cognitive, and affective components (Fredricks et al., 2004), is a critical mediator of learning outcomes in PE. Research suggests that different instructional models activate different engagement dimensions, yet few studies have directly compared DI and IBT on comprehensive engagement measures within PE contexts (Chen & Darst, 2001).

This study addresses this gap by conducting a systematic comparison of DI and IBT across multiple engagement dimensions and physical literacy outcomes. The crossover design allows each student to experience both conditions, controlling for individual differences and providing a robust basis for comparison.

II. LITERATURE REVIEW

2.1. Direct Instruction in Physical Education

Direct instruction in PE follows a structured sequence: teacher explanation, demonstration, guided practice, independent practice, and assessment (Rink, 2020). Research consistently demonstrates that DI is effective for developing specific motor skills, particularly during early stages of learning when learners benefit from explicit guidance and modeling (Magill & Anderson, 2017). Silverman et al. (1995) found that DI maximized academic learning time in PE (ALT-PE), a proxy for motor engagement that is strongly correlated with skill improvement.

However, critics argue that exclusive reliance on DI may foster passive learning, limit student autonomy, and fail to develop the metacognitive and problem-solving skills necessary for independent physical activity engagement (Kirk, 2010). Metzler (2017) noted that while DI excels in achieving psychomotor objectives, it may underserve the cognitive and affective domains that are increasingly recognized as essential PE outcomes.

2.2. Inquiry-Based Teaching in Physical Education

Inquiry-based teaching encompasses pedagogical approaches that position students as active constructors of knowledge through exploration, questioning, and problem-solving (Light, 2013). In PE, IBT manifests through teaching styles such as guided discovery, divergent production, and Teaching Games for Understanding (TGfU), which challenge students to develop tactical awareness and movement solutions rather than reproducing predetermined motor patterns (Bunker & Thorpe, 1982).

Research on IBT in PE has yielded promising results. Harvey and Jarrett (2014) conducted a systematic review of game-based approaches and found consistent evidence of improved tactical knowledge, decision-making, and game performance compared to technique-focused approaches. Light and Wallian (2008) demonstrated that inquiry-based pedagogies enhanced student motivation, engagement, and understanding of movement concepts in secondary PE.

However, concerns remain about the efficiency of IBT for developing foundational motor skills, particularly for novice learners who may lack the prerequisite knowledge to engage productively in open-ended inquiry tasks (Kirschner et al., 2006). Additionally, IBT places greater demands on teacher pedagogical content knowledge and classroom management skills (Wright et al., 2005).

2.3. Physical Literacy as an Integrated Outcome

Physical literacy provides a comprehensive framework for evaluating PE outcomes that transcends traditional skill-based measures. Whitehead's (2019) conceptualization encompasses four interrelated domains: physical competence, knowledge and understanding, motivation and confidence, and engagement in physical activity. Edwards et al. (2017) developed assessment tools capturing these domains, enabling researchers to evaluate how different pedagogical approaches contribute to holistic physical literacy development.

III. METHODOLOGY

3.1. Research Design

A randomized crossover design was employed, in which all participants experienced both DI and IBT conditions across two 8-week instructional units. The order of conditions was counterbalanced across classes to control for sequence effects. Unit 1 covered invasion games (basketball/soccer) and Unit 2 covered net/wall games (badminton/volleyball). Half of the classes received DI first and IBT second, while the remaining classes received the reverse order.

3.2. Participants

A total of 210 students (112 males, 98 females; ages 13–16, M = 14.5, SD = 1.2) from three secondary schools participated. Six PE teachers (3 male, 3 female; mean teaching experience = 9.4 years) delivered both conditions after receiving specialized training in each approach. Students with physical disabilities that prevented full participation were excluded from quantitative analyses but were included in all lessons with appropriate modifications.

3.3. Instructional Conditions

The DI condition followed Rink's (2020) task progression model: teacher demonstration, explanation of key performance criteria, structured practice with progressive complexity, specific corrective feedback, and summative skill assessment. Lessons followed a consistent format of warm-up (10 min), skill instruction and practice (25 min), and application activity (10 min).

The IBT condition employed a TGfU framework (Bunker & Thorpe, 1982) integrated with guided discovery elements. Lessons began with modified game forms that highlighted tactical problems, followed by guided questioning to elicit student understanding, practice tasks designed by students to address identified needs, and return to game play. The teacher's role shifted from demonstrator to facilitator, using questioning strategies to guide student thinking.

3.3. Measures

Student engagement was assessed through three measures:

- The Student Engagement Instrument for PE (SEI-PE; Shen et al., 2012), measuring cognitive, affective, and behavioral engagement via self-report;
- Systematic observation using the ALT-PE instrument (Siedentop et al., 1982) to quantify motor engagement time; and
- Actigraph GT3X accelerometers worn during lessons to measure physical activity intensity.

Physical literacy was assessed using a composite measure adapted from Edwards et al. (2017), incorporating: physical competence (sport-specific skill tests), knowledge and understanding (written tactical/strategic knowledge test), motivation

and confidence (Physical Activity Enjoyment Scale and physical self-efficacy scale), and daily physical activity (7-day accelerometry outside PE).

3.4. Data Analysis

Linear mixed-effects models were used to account for the crossover design, with instructional condition as a fixed effect and participant and school as random effects. Period effects and carry-over effects were tested. Effect sizes (Cohen's d) were calculated for all comparisons. Significance was set at $p < .05$ with Bonferroni corrections for multiple comparisons.

IV. RESULTS

4.1. Student Engagement

The IBT condition produced significantly higher cognitive engagement scores ($M = 4.12$, $SD = 0.71$) compared to DI ($M = 3.41$, $SD = 0.83$), $t(209) = 8.94$, $p < .001$, $d = 0.82$. Affective engagement was also significantly higher under IBT ($M = 4.28$, $SD = 0.65$) than DI ($M = 3.87$, $SD = 0.74$), $t(209) = 5.71$, $p < .01$, $d = 0.61$. However, DI yielded significantly more ALT-PE motor engaged time ($M = 38.2\%$, $SD = 8.4$) compared to IBT ($M = 33.7\%$, $SD = 9.1$), $t(209) = 3.42$, $p < .05$, $d = 0.44$.

Table 1. Student Engagement Outcomes by Instructional Condition

Engagement Dimension	DI M(SD)	IBT M(SD)	T	p	d
Cognitive (SEI-PE)	3.41 (0.83)	4.12 (0.71)	8.94	<.001	0.82
Affective (SEI-PE)	3.87 (0.74)	4.28 (0.65)	5.71	<.01	0.61
Behavioral (SEI-PE)	3.92 (0.69)	3.98 (0.72)	0.84	.40	0.09
Motor Engaged (ALT-PE %)	38.2 (8.4)	33.7 (9.1)	3.42	<.05	0.44
MVPA minutes/lesson	18.4 (4.2)	16.8 (4.8)	2.87	<.05	0.35

4.2. Physical Literacy Outcomes

The physical literacy composite score was significantly higher under IBT ($M = 72.4$, $SD = 11.2$) compared to DI ($M = 66.8$, $SD = 12.6$), $F(1, 208) = 12.34$, $p < .01$, $d = 0.57$. Domain-level analysis revealed that IBT advantages were concentrated in knowledge and understanding ($d = 0.78$) and motivation and confidence ($d = 0.65$), while physical competence scores did not differ significantly between conditions ($d = 0.18$, $p = .21$).

Table 2. Physical Literacy Domain Scores by Instructional Condition

Physical Literacy Domain	DI M(SD)	IBT M(SD)	F	p	d
Physical Competence	74.2 (13.1)	76.5 (12.8)	1.58	.21	0.18
Knowledge & Understanding	58.4 (14.7)	69.8 (13.2)	28.64	<.001	0.78
Motivation & Confidence	68.3 (11.9)	75.8 (10.4)	18.92	<.001	0.65
Daily PA Behavior	66.4 (15.2)	67.5 (14.8)	0.24	.62	0.07
Composite Score	66.8 (12.6)	72.4 (11.2)	12.34	<.01	0.57

4.3. Moderating Effects

Gender moderated the relationship between instructional condition and affective engagement, with female students showing a larger IBT advantage ($d = 0.81$) compared to males ($d = 0.42$). Prior experience also moderated physical competence outcomes: novice students showed greater skill gains under DI ($d = 0.52$), while experienced students demonstrated comparable skill development across conditions.

V. DISCUSSION

This study provides nuanced evidence regarding the comparative effectiveness of direct and inquiry-based instruction in PE. Rather than identifying a universally superior approach, the findings reveal complementary strengths that inform a more sophisticated understanding of instructional model selection.

The cognitive and affective engagement advantages of IBT align with constructivist learning theory and self-determination theory (Deci & Ryan, 2000). By positioning students as active problem-solvers and decision-makers, IBT inherently supports autonomy and competence needs, fostering deeper investment in the learning process. The substantial effect size for cognitive engagement ($d = 0.82$) is particularly significant given the importance of tactical understanding and strategic thinking in lifelong physical activity participation (Light, 2013).

Conversely, DI's advantage in motor engaged time confirms its efficiency for maximizing practice opportunities, which is especially important for novice learners who require repetition to develop foundational movement patterns (Magill & Anderson, 2017). The finding that novice students benefited more from DI in physical competence aligns with the expertise reversal effect described by Kirschner et al. (2006), whereby explicit instruction benefits learners who lack the prior knowledge to engage effectively in open-ended tasks.

The physical literacy analysis provides perhaps the most important finding: while both models produced comparable physical competence outcomes, IBT significantly enhanced the cognitive and motivational dimensions of physical literacy. This suggests that exclusive reliance on DI may produce technically proficient but motivationally disengaged students a concerning outcome given that physical literacy aims to foster lifelong physical activity engagement (Whitehead, 2019).

The gender moderation effect suggests that IBT may be particularly beneficial for female students, who have historically reported lower PE engagement and satisfaction (Gibbons, 2009). The collaborative, less competitive nature of IBT environments may create more inclusive participation structures that better serve diverse learner populations.

Limitations include the relatively short intervention periods, which may not capture long-term pedagogical effects. The study relied on teachers implementing both conditions, introducing potential contamination effects despite the washout period. Future research should examine optimal sequencing and integration of DI and IBT within single units.

VI. CONCLUSION

This study demonstrates that direct instruction and inquiry-based teaching make distinct but complementary contributions to student engagement and physical literacy development in PE. DI excels in maximizing motor practice time and developing foundational skills for novice learners, while IBT promotes deeper cognitive and affective engagement and enhances the knowledge, motivation, and confidence dimensions of physical literacy. These findings support a pedagogical approach that strategically integrates both models, leveraging DI for skill development phases and IBT for tactical understanding and motivational development. PE teacher education programs should prepare teachers to be proficient in both approaches and to make informed decisions about when and how to deploy each model based on learning objectives, student characteristics, and content demands.

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