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Original article

Diagnosis of interdisciplinary relationships between Physical Education and Agricultural Production in Agronomy

Diagnóstico de las relaciones interdisciplinarias entre Educación Física y Producción Agropecuaria en Agronomía

Diagnóstico das relações interdisciplinares entre Educação Física e Produção Agropecuária em Agronomia

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ABSTRACT

The training of agricultural engineers required effective integration among the curriculum's disciplines. However, a fragmentation between Physical Education and Agricultural Production was documented, limiting comprehensive training. The objective of this study was to diagnose the current state of interdisciplinary relationships between these two disciplines in the Agronomy program at the Hermanos Saíz Montes de Oca University of Pinar del Río. A mixed-methods approach, based on Advanced Educational Technology, was applied, parameterizing the single variable in the didactic, pedagogical, and extension dimensions. Six instruments were administered to a sample composed of students, faculty, and staff. The results identified significant problems in all three dimensions, highlighting faculty's lack of awareness of interdisciplinary connections and the absence of

interdisciplinary organization in most classes. Conversely, a high level of student motivation toward knowledge integration was observed. It was concluded that there was a contradiction between the curricular mandate of integration and a fragmented educational practice, which empirically justified the design of a specific pedagogical strategy for this context.

Keywords: agronomy; educational diagnosis; physical education; university extension; interdisciplinarity.

RESUMEN

La formación del ingeniero agrónomo demandó una articulación efectiva entre las disciplinas del currículo. No obstante, se documentó una fragmentación entre la Educación Física y la Producción Agropecuaria que limitó la formación integral. El objetivo del estudio fue diagnosticar el estado actual de las relaciones interdisciplinarias entre ambas disciplinas en la carrera de Agronomía de la Universidad de Pinar del Río Hermanos Saíz Montes de Oca. Se aplicó un enfoque mixto, sustentado en la Tecnología de la Educación Avanzada, parametrizando la variable única en las dimensiones didáctica, pedagógica y extensionista. Se aplicaron seis instrumentos a una muestra compuesta por estudiantes, docentes y funcionarios. Los resultados identificaron problemas significativos en las tres dimensiones, destacando el desconocimiento de los nodos interdisciplinarios por parte de los docentes y la ausencia de organización interdisciplinaria en la mayoría de las clases. Como contrapartida, se constató una alta motivación estudiantil hacia la integración de saberes. Se concluyó que existió una contradicción entre el mandato curricular de integración y una práctica educativa fragmentada, lo que justificó empíricamente el diseño de una estrategia pedagógica específica para este contexto.

Palabras clave: agronomía; diagnóstico educacional; educación física; extensión universitaria; interdisciplinariedad.

RESUMO

A formação do engenheiro agrônomo exigiu uma articulação efetiva entre as disciplinas do currículo; no entanto, foi documentada uma fragmentação entre a Educação Física e a Produção Agropecuária que limitou a formação integral. O objetivo do estudo foi diagnosticar o estado atual das relações

interdisciplinares entre ambas as disciplinas no curso de Agronomia da Universidade de Pinar del Río. Utilizou-se uma abordagem mista, baseada na Tecnologia da Educação Avançada, parametrizando a variável única nas dimensões Didática, Pedagógica e Extensionista. Seis instrumentos foram aplicados a uma amostra composta por estudantes, docentes e funcionários. Os resultados identificaram problemas significativos nas três dimensões, destacando-se o desconhecimento dos nós interdisciplinares por parte dos docentes e a ausência de organização interdisciplinar na maioria das aulas. Como contrapartida, constatou-se uma alta motivação estudantil para a integração de saberes. Concluiu-se que existiu uma contradição entre o mandato curricular de integração e uma prática educativa fragmentada, o que justificou empiricamente o desenho de uma estratégia pedagógica específica para este contexto.

Palavras-chave: agronomia; diagnóstico educacional; educação física; extensão universitária; interdisciplinaridade.

INTRODUCTION

Cuban higher education conceives of professional training as a comprehensive process that integrates instruction, education, and development. In the Agronomy program, Study Plan E (2017) establishes interdisciplinarity as the organizing principle of the curriculum and assigns the discipline of Agricultural Production the role of Main Integrative Discipline (DPI), conceived as the central axis that integrates the substantive processes of training, research, and outreach, with the explicit responsibility of contributing to the acquisition of professional practices (Rodríguez Jiménez *et al.*, 2022). This curriculum design aims for a graduate with systemic thinking, capable of mobilizing knowledge to solve complex problems in the agri-food sector, within the framework of the university-industry relationship.

Multiple studies have pointed to difficulties in the practical implementation of this integrative ideal. Research conducted at various Cuban universities concurs that teaching tasks do not sufficiently stimulate active inquiry and critical analysis of content, thus limiting the development of interdisciplinary approaches (Giraudy Chedebeaux *et al.*, 2024). In particular, it has been observed that general education disciplines (including Physical Education) tend to be excluded from curricular integration strategies, remaining in a parallel coexistence with the professional core curriculum, without establishing substantive links between it and general education.

University Physical Education in Cuba has undergone a long process of curricular evolution. From the first study plans to the current Plan E, the discipline has attempted to move beyond a predominantly sports-oriented approach, focused on competitive performance and physical efficiency tests, towards a more professionalized and salutogenic conception (Hortigüela *et al.*, 2022). The current program for the Agronomy degree recognizes that future agronomists will work in a rural environment with specific physical demands. However, several critical analyses indicate that this recognition has not translated into effective curricular implementation: the course objectives remain generic, the content is presented out of context from agricultural tasks, and the evaluation system does not include indicators of transfer to the professional context (López *et al.*, 2020). Recent research in Physical Education teacher training confirms that the implementation of the competency-based curriculum, although prescribed, lacks the necessary monitoring mechanisms to ensure its coherence with teaching practice (Hurtado & Páez, 2024).

This situation has been characterized by the author as a pedagogical paradox: the curriculum declares comprehensiveness as a guiding principle, but the training practice reduces Physical Education to a physical activity disconnected from the professional competencies of the agronomist. In the specific case of the University of Pinar del Río Hermanos Saíz Montes de Oca, preliminary studies have suggested that interdisciplinary relationships between Physical Education and Agricultural Production are practically nonexistent, although until now there has been no systematic diagnosis that accurately describes the state of this articulation in its didactic, pedagogical, and extension dimensions.

Specialized literature has identified that one of the obstacles to effective integration lies in the particular nature of Physical Education as a movement discipline. Cuban pedagogy has developed a valuable conceptual framework for interdisciplinarity, which includes interdisciplinary nodes, interobjects, generating cells, and guiding principles (López *et al.*, 2026). These categories have proven effective in diverse cognitive contexts, such as Civil Engineering, where Pedroso *et al.* (2024) articulate content from Topography and Mathematics; or the Social Sciences, where Rodríguez Saint-Hilaire *et al.* (2025) integrate History, Geography, and Civics. This background demonstrates the effectiveness of interdisciplinary nodes in articulating disciplines that share a cognitive-conceptual substrate. However, the present analysis argues that these categories are insufficient when it comes to articulating disciplines that operate in the domain of the body and motor skills.

When applied to the specific link between Physical Education, a discipline of movement, and Agricultural Production, a discipline of physical labor, structural limitations emerge that have not been sufficiently

addressed. Traditional categories were conceived to articulate declarative concepts and knowledge. It is argued that these categories are insufficient to integrate conditional capacities, coordinative skills, and bodily experiences, which constitute forms of embodied knowledge irreducible to conceptual logic (López *et al.*, 2026). Nor were they designed to incorporate the ergonomic and preventative dimension, which is precisely what gives meaning to this articulation in the agricultural context (Shivakumar *et al.*, 2024). As Sørensen and Stenalt (2025) have pointed out, epistemic and organizational dilemmas persist that hinder the actual implementation of interdisciplinarity; Naganuma *et al.* (2025) call for conceptual frameworks sensitive to the specific disciplinary context.

From the author's perspective, this limitation is not merely operational, but rather reveals a deeper epistemic issue. Traditional interdisciplinary categories stem from a Cartesian-rooted fragmentation that has artificially divorced theory from practice, intellectual work from manual labor, and mind from body. Consequently, a theoretical void has been consolidated: neither Cuban pedagogical literature nor the most advanced international frameworks contain categories specifically designed to model the dialogue between embodied knowledge, such as that of Physical Education, and productive praxis, such as that of Agronomy, when both converge in the worker's body and in the real context of their future profession.

The social relevance of addressing this issue is significant. A recent systematic review and meta-analysis of agricultural workers in low- and middle-income countries reported a combined 12-month prevalence of low back pain of 61.96% in Africa, 54.16% in Asia, and 28.52% in South America (Shivakumar *et al.*, 2024). Similarly, studies in Ecuador report that 81.8% of agricultural workers suffer from low back pain, 69.5% maintain an elevated arm posture, and 64.8% work with constant knee flexion (Almeida Duarte *et al.*, 2025). In the Cuban context, research in cooperatives in Havana province has documented that between 75% and 100% of workers perform repetitive movements and adopt awkward postures during their workday (Argote Ravelo & Caballero Poutou, 2019). These data underline the urgency that the training of agricultural engineers includes, from early stages, specific preparation in safe lifting techniques, postural hygiene and injury prevention.

Given this situation, it is necessary to have a precise diagnosis that characterizes the current state of interdisciplinary relationships between Physical Education and Agricultural Production in the Agronomy program at the University of Pinar del Río Hermanos Saíz Montes de Oca. Such a diagnosis will allow us to identify not only the problems hindering integration, but also existing potential—such as the favorable framework of Study Plan E, the institutional recognition of the value of Physical Education, and student motivation—which can serve as a basis for future pedagogical interventions.

For all the above reasons, the present study aimed to diagnose the current state of interdisciplinary relationships between Physical Education and Agricultural Production in the Agronomy degree at the University of Pinar del Río.

MATERIALS AND METHODS

A mixed-methods approach was employed, combining theoretical and empirical methods articulated through methodological triangulation. The diagnostic procedure was based on Advanced Educational Technology, which establishes seven steps: contextual analysis, parameterization, ideal model, current state assessment, comparison, problem prioritization, and solution pathways. This methodology has been successfully applied in recent pedagogical research to diagnose the state of complex educational processes.

The single variable (interdisciplinary relationships between Physical Education and Agricultural Production) was parameterized in three dimensions with nine indicators. The didactic dimension assessed the presence of interdisciplinarity in the classroom using three indicators: organization of interdisciplinary relationships in classes, identification of interdisciplinary nodes, and relationships among the components of the teaching-learning process (objectives, content, methods, resources, and assessment). The pedagogical dimension focused on teacher preparation through the following indicators: methodological preparation for developing interdisciplinary relationships, motivation toward the agricultural profession through Physical Education classes, and alignment of content with the core processes of agricultural education (teaching, research, and outreach). The outreach dimension assessed community engagement using three indicators: participation in integrated outreach activities, involvement in community projects and agricultural fairs, and contribution to the development of a physical and ergonomic culture in rural communities.

Six data collection instruments were used. The document review encompassed Study Plan E, the syllabi for the Physical Education and Agricultural Production disciplines, the departmental methodological work strategy, and the extension work plan. A semi-structured interview was conducted with the five Physical Education professors who teach first- and second-year students. A survey was administered to the 36 first-year students. Twelve observations of Physical Education classes were carried out throughout the first semester. Five officials from the Faculty of Agronomy and Forestry (dean, vice-deans, department heads, and vice-rector's advisors) were interviewed. Finally, the daily activity logs completed by the participating professors were analyzed.

The sample was a non-probabilistic, purposive sample, comprised of all 36 first-year students in the Agronomy program (100% of the enrollment), all five Physical Education instructors teaching in the program (100%), and five of the ten faculty members involved in academic activities (50%). The instruments were administered during the first semester of the 2024-2025 academic year at the Hermanos Saíz Montes de Oca University of Pinar del Río.

Methodological triangulation was used for data analysis, applying the following decision rule: indicators with a positive rating between 80% and 100% were considered strengths, while indicators with a negative rating between 0% and 50% were considered weaknesses. The study adhered to the ethical principles of educational research, guaranteeing participant anonymity and informed consent.

RESULTS

The results are presented organized by the three dimensions of the parameterization.

Didactic dimension. The document review revealed that the subject curricula lack explicit guidelines for establishing interdisciplinary relationships. Interviews with teachers revealed that 80% indicated that, while the Physical Education program establishes a general framework for interdisciplinarity, it lacks explicit guidelines and clear procedures for its implementation. 100% of the teachers stated they were unaware of the existing interdisciplinary connections between the two disciplines. Classroom observations confirmed that in 91.7% of the sessions, no organization of interdisciplinary relationships was observed, and in 100%, no points of articulation were identified. The student survey corroborated that 83.4% had never perceived links between the content of the two disciplines, and 100% stated that they had never been assigned integrative teaching tasks.

Pedagogical dimension. 100% of the teachers reported not having received specific methodological training in interdisciplinarity. Likewise, 100% attempt to link class objectives to national and international sporting achievements, without connecting them to the agronomic profile. Officials agreed that they are unaware of the practical ways to implement the interdisciplinary approach, noting that general education subjects, such as Physical Education, are furthest removed from these strategies, even though the curriculum formally includes them.

Extension dimension. The results confirmed that, beyond participation in the Internal Games and the Guamá Games (sports and recreational events), there are no planned activities within Physical Education that integrate specific content with the agronomic profile. Classroom observations were

conclusive: in no session was participation in community projects, agricultural fairs, or health promotion activities in the rural environment promoted, nor were physical culture and ergonomics content for agricultural work addressed.

An illustrative example of an unidentified node

During the observations, it was noted that the classes addressed the importance of strength and exercise from their physical, physiological, and biomechanical foundations. However, the connection between the weightlifting techniques practiced in the gym (such as deadlifts) and their application to lifting a 40 kg sack of fertilizer in a field exercise was not established. While the students performed the exercises with correct technique, it was not explicitly explained how to transfer this motor skill to professional activity or how biomechanical principles contribute to protecting the lumbar spine during agricultural work. This situation suggests the need to strengthen the identification and operationalization of interdisciplinary nodes in teaching practice.

Identified potentialities

Among the positive aspects, it is noteworthy that 95% of students expressed interest in Physical Education contributing to their preparation for fieldwork, and that 100% of staff recognized the subject's educational value. Furthermore, Study Plan E provides a favorable institutional framework for interdisciplinary integration. These findings, along with the identified potentialities, are summarized in table 1.

Table 1. Summary of the main findings by dimension

Dimension	Main problems identified	Potential
Didactics	Lack of awareness of the nodes; 91.7% of classes without interdisciplinary organization	Favorable curriculum framework (Plan E)
Pedagogical	Teachers without specific methodological training in interdisciplinarity	Institutional recognition of the value of EF (100%)
Extensionist	100% of classes without community outreach; absence of ergonomic culture	High motivation student (95%)

Source: Prepared by the authors based on the instruments applied

DISCUSSION

The study's findings empirically confirm the existence of a significant curricular fragmentation between Physical Education and Agricultural Production in the training of agricultural engineers, as previously noted in the literature (Giraudy Chedebeaux *et al.*, 2024). The convergence of these results with those of other authors reinforces the idea that this is not an isolated problem, but rather a trend requiring systemic intervention.

The identified pedagogical paradox—a curriculum that proclaims comprehensiveness but a practice that fails to achieve it—is reflected in the collected data. The diagnostic results reveal that all teachers stated they were unfamiliar with interdisciplinary approaches, and that in most of the observed classes, there was no evidence of organized interdisciplinary relationships.

These findings, rather than pointing to individual shortcomings, highlight the need to strengthen methodological preparation processes and the building of bridges between disciplines. This contradiction is not attributable to a single cause, but rather stems from the confluence of historical, curricular, and didactic factors. For decades, Physical Education was subordinated to athletic performance, an inertia that has hindered its professionalization toward an agronomic profile (Hortigüela *et al.*, 2022).

The finding that teachers have not received specific methodological training in interdisciplinarity coincides with what has been reported by other authors in the Cuban context (Giraudy *et al.*, 2024). Traditional interdisciplinary categories (nodes, generating cells, guiding lines), despite their value in cognitive contexts, are insufficient to articulate the bodily knowledge of Physical Education with the productive practice of Agronomy, especially in relation to the ergonomic and preventive dimensions (Sørensen & Stenalt, 2025; Naganuma *et al.*, 2025).

Implications of the Identified Theoretical Gap. From the author's perspective, this diagnosis reveals a theoretical gap of epistemic scope. Existing conceptual tools were designed to articulate disciplines that share the same cognitive-conceptual substrate, not to integrate embodied knowledge (movement, strength, resistance) with productive praxis (agricultural work) when both converge in the professional's body. This theoretical gap helps explain why teachers, even with a positive disposition, find it difficult to establish interdisciplinary bridges: they lack a specific conceptual framework to guide their practice. The solution, therefore, lies not only in more methodological work, but also in the construction of

intermediate categories that allow for modeling the relationship between physical training and the ergonomic demands of fieldwork.

Comparison with other international contexts. The fragmentation diagnosed here is not exclusive to the Cuban context. Research in Latin America and Europe has documented similar difficulties in integrating Physical Education with technical and agricultural programs (Shivakumar *et al.*, 2024; Sørensen & Stenalt, 2025). However, the present study contributes a novel element: the parameterization of the problem into dimensions (didactic, pedagogical, and extension-based) allows for the precise identification of where the greatest weaknesses are concentrated and where exploitable potential exists (high student motivation and a favorable curricular framework). This level of detail is unusual in the reviewed literature.

The extension dimension, included as a methodological decision specific to this study, emerged as the area requiring the greatest development in the articulation between Physical Education and Agricultural Production. The results showed that community outreach activities from the discipline are still in their early stages, representing an opportunity to strengthen occupational risk prevention through university education. This finding is particularly relevant considering the high prevalence of musculoskeletal disorders in the agricultural sector globally (Shivakumar *et al.* 2024; Argote Ravelo & Caballero Poutou, 2019). It is not only about students learning to care for their own bodies, but also about them, as future professionals, being able to transfer this knowledge to the producers they will work with, thus contributing to the occupational health of rural communities.

Identifying strengths such as high student motivation and institutional recognition of the value of Physical Education allows for optimism about the future. This motivational foundation, combined with the favorable framework of Study Plan E, empirically justifies the need for and feasibility of a pedagogical strategy to overcome the identified deficiencies. The strategy should include at least three components: a professional development program for teachers focused on embodied interdisciplinarity, the development of explicit curricular guidelines that identify specific learning areas (for example, the relationship between deadlifts and lifting sacks of fertilizer), and the design of outreach projects that bring ergonomic prevention to the communities where students complete their work placements.

Among the limitations of this study is its local nature, confined to a single university. Therefore, future research could replicate the diagnosis in other institutions to verify the generalizability of the findings. Furthermore, the cross-sectional design does not allow for establishing causal relationships, suggesting

the advisability of longitudinal studies that evaluate the evolution of these indicators after the implementation of interventions. Another limitation is the small sample size of faculty members (5), although it represents 100% of the population at this university; future studies with larger samples would allow for more robust statistical analyses.

In conclusion, the current state of interdisciplinary relationships between Physical Education and Agricultural Production in the Agronomy program at the University of Pinar del Río was diagnosed, revealing a contradiction between the curricular mandate of integration and a fragmented educational practice. The empirical evidence gathered, by systematically documenting existing problems and potential, provides a solid foundation that justifies the design of an interdisciplinary pedagogical strategy.

This future intervention should focus on three fundamental areas: the methodological preparation of faculty in embodied interdisciplinarity, the development of explicit curricular guidelines to guide the teaching staff (identifying specific areas such as safe lifting, stamina for long workdays, and the prevention of repetitive motion injuries), and an outreach program that links the training of agricultural engineers with the real occupational health needs of rural communities. The results of this assessment have direct implications for the training of agricultural engineers in Cuba.

The observation that most students want Physical Education to contribute to their preparation for fieldwork, coupled with the fact that most have never perceived any link between the two disciplines, reveals an unmet educational need. This gap between what students expect and what the curriculum offers constitutes, in itself, empirical justification for designing pedagogical interventions that bring Physical Education closer to the real demands of the agricultural profession. In short, this diagnosis confirms that the pedagogical paradox is expressed in concrete educational practice and that overcoming it requires transformations in how we conceive of the relationship between the body, work, and the curriculum. The task is set, and the data presented here offer a compass to guide future efforts.

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Conflict of interest

Authors declare no conflict of interests.

Authors' contribution

The authors participated in the design and writing of the article, in the search and analysis of the information contained in the consulted bibliography.

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