Blended Learning and Flipped Classrooms Effectiveness in Physical Education Courses: A Student-Centered Perspective

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Abstract: This study examines student perceptions and satisfaction across three teaching modalities (face-to-face, blended learning, and flipped classroom) in higher education, focusing specifically on social interaction dynamics, feedback effectiveness, and overall learning experience. The study employed a quantitative approach using a ranking-based survey administered to 300 students with experience with all three teaching methods. Participants ranked each modality on a 3-point scale across three dimensions: social interaction, instructor feedback effectiveness, and overall learning satisfaction. Data analysis utilized Friedman's test to determine the statistical significance of differences between teaching modalities. Statistical analysis revealed significant differences across all three dimensions ($p < 0.05$). Face-to-face instruction consistently received higher rankings for social interaction (mean rank = 2.14, $p = 0.011$), feedback effectiveness (mean rank = 2.17, $p = 0.00047$), and overall learning satisfaction (mean rank = 2.21, $p = 0.00008$). Blended learning maintained intermediate rankings across all dimensions (mean ranks: 1.95-2.01), while the flipped classroom approach showed lower preference ratings (mean ranks: 1.82-1.89). While face-to-face instruction remains the preferred teaching modality across all measured dimensions, blended learning emerges as a viable alternative, particularly in scenarios where traditional face-to-face instruction may not be feasible. These findings provide valuable insights for educational institutions seeking to optimize their teaching approaches and suggest the importance of maintaining strong interpersonal elements in educational delivery, regardless of the chosen modality.

Keywords: *Blended Learning Flipped Classrooms, Physical Education, Curriculum Enhancement.*

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Introduction

In recent decades, the integration of technology into educational practices has introduced innovative teaching strategies to enhance the student learning experience. Among these strategies, blended learning and the flipped classroom model have garnered significant attention for their potential to improve instructional organization and student engagement. In physical education, these approaches offer a unique opportunity to bridge the gap between theoretical knowledge and practical application. Blended learning enables students to access online tutorials and track their progress through technology, while the flipped classroom allows them to acquire foundational knowledge before class, focusing in-person sessions on skill development and teamwork.

Blended learning merges on-site classes with virtual classrooms to create an engaging and flexible learning environment. It not only boosts student participation but also caters to diverse learning preferences, allowing students to access instructional materials when they are ready to absorb the content. This model encourages meaningful interaction with learning resources, promoting deeper understanding and engagement. On the other hand, the flipped classroom model reimagines the learning process by shifting the initial phase of instruction outside the classroom—typically through videos or other digital resources—so that class time can be devoted to collaborative activities, practical exercises, and peer-to-peer learning. These approaches have been valuable in physical education, which has traditionally been dominated by face-to-face interactions.

However, the successful implementation of these methods is not without challenges; ensuring equitable access to technology and overcoming resistance to change among educators and administrators are just a few to mention. Addressing these barriers is crucial for maximizing the effectiveness of blended and flipped learning in physical education. This paper sought to explore the integration of both methodologies to examine their advantages, limitations, and potential for transforming teaching and learning in this field. By harmonizing these approaches, educators can create more engaging, adaptable, and effective learning experiences, ultimately leading to improved student outcomes in physical education.

This study investigated students' perspectives on these instructional methods. It explored and evaluated the impact on students'

experiences and learning outcomes in physical education (PE). It aimed to assess students' attitudes, determine their level of receptiveness, and the influence on engagement and overall effectiveness by ranking these methods based on skill acquisition, retention of theoretical knowledge, application of theory to practice, flexibility of learning, overall satisfaction, social interaction, and instructor feedback.

Furthermore, it identified the challenges and barriers students encountered and determined the relative effectiveness of these modern approaches against the traditional methods. It also gathered students' recommendations to make them more effective and relevant to their learning needs. Ultimately, the goal is to provide insights that will guide educators in optimizing teaching strategies and enhancing students' learning experiences in physical education.

Importance of the Study

This study provided critical insights into the effectiveness of blended learning and flipped classrooms in physical education (PE) courses. It explored students' attitudes and perceptions and identified factors that promote or hinder the successful implementation of these innovative teaching methods. The lack of direct rankings suggests a need for further research, particularly studies that use surveys or questionnaires to ask students to rank these methods based on skill acquisition, retention of theoretical knowledge, application of theory to practice, flexibility of learning, overall satisfaction, social interaction, and instructor feedback. Additionally, understanding the challenges and barriers faced by students offers valuable guidance for improving accessibility and inclusivity. This would help educators tailor physical education courses to student preferences, enhancing engagement and learning outcomes.

Statement of the Problem

1. What are students' attitudes toward the use of blended learning and flipped classrooms in physical education courses?'

2. How effective are blended learning and flipped classroom approaches in improving learning outcomes in physical education courses?

3. What challenges and barriers do students experience in implementing blended learning and flipped classrooms in physical education courses?

4. Is there a significant difference in how respondents rank blended learning, flipped classrooms, and traditional methods in terms of effectiveness in skill acquisition, retention of theoretical knowledge, application of theory to practice, flexibility of learning, overall satisfaction, social interaction, and instructor feedback?

5. What suggestions do students want for improving the use of blended learning and flipped classrooms in Physical Education?

Hypothesis

Null Hypothesis (H_0): There is no significant difference in how respondents rank blended learning, flipped classrooms, and traditional methods in terms of effectiveness in skill acquisition, retention of theoretical knowledge, application of theory to practice, flexibility of learning, overall satisfaction, social interaction, and instructor feedback.

Alternative Hypothesis (H_1): There is a significant difference in how respondents rank blended learning, flipped classrooms, and traditional methods across one or more of the following dimensions: effectiveness in skill acquisition, retention of theoretical knowledge, application of theory to practice, flexibility of learning, overall satisfaction, social interaction, and instructor feedback.

Conceptual Framework

This study is grounded in Blended Learning Theory, the Flipped Classroom Model, and Constructivist Learning Theory, and aims to provide a longitudinal and in-depth examination of how these innovative teaching methods impact student attitudes, learning outcomes, and experiences in physical education (PE). The framework sought to understand how these approaches can be optimized to enhance both theoretical understanding and practical skill development. It compared the effectiveness of blended learning, flipped classrooms, and traditional teaching methods in PE. This comparison provided insights into how each approach can enhance students' learning experiences and explored students' perceptions, contributing to the optimization of these teaching methods for physical education courses.
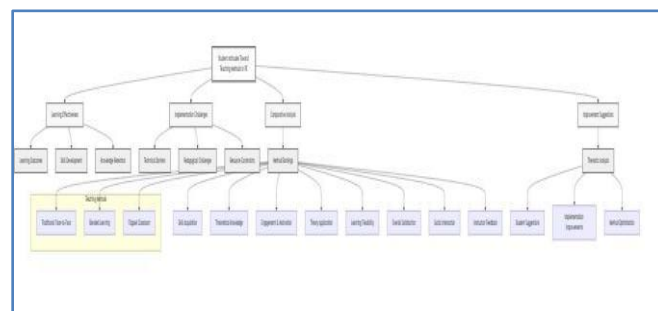
Related Literature and Studies

Constructivism provides the theoretical underpinning for modern educational approaches, asserting that knowledge is actively constructed through experiences and interactions rather than passively received [41]. This learning theory emphasizes student-centered learning and manifests in two primary forms: radical constructivism, focusing on individual interpretation, and social constructivism, emphasizing knowledge construction through social interaction [10]. The theory maintains that knowledge is not merely a reflection of external reality but an adaptive function organizing the experiential world [1] Constructivist learning environments promote student independence, active learning, collaboration, and peer teaching, aiming to enhance conceptual understanding by constantly assessing learning activities [6].

The flipped classroom aligns seamlessly with constructivism theory because it promotes active, student-centered learning, where students construct their knowledge through interaction and experience. It is an innovative pedagogical approach that leverages technology to shift lecture content outside of class, enabling more interactive, problem-solving activities during class time [21][32]. This method synthesizes elements of constructivist and behaviorist learning theories [8][13] The approach facilitates increased one-on-one interaction between teachers and students, supports mastery learning, and provides opportunities for differentiation and problem-based inquiry [21]. Meta-analyses have demonstrated the positive effects of flipped classrooms on student achievement and cognitive learning outcomes. In secondary education, studies reveal a moderate positive effect (Cohen's d = 0.42) compared to

traditional instruction, with particularly strong results in STEM subjects and shorter interventions [39] . Higher education implementations show increased student engagement and improved performance [26]. Six main factors affect flipped classroom effectiveness, including student and teacher characteristics, implementation strategies, and task design [30].

Similarly, blended learning aligns well with **constructivist learning theory** because it integrates multiple modalities and promotes active, student-centered, and experiential learning. It combines traditional face-to-face instruction with online or technology-supported learning methods [2][7] This approach has experienced significant global growth, with annual rates exceeding 46% [16], and has been implemented across various educational settings, including higher education and professional development training [16]

Multiple studies demonstrate that blended learning environments outperform both purely online and traditional face-to-face instruction [12][3]. This success is attributed to the combination of collaborative and direct-instructed techniques, along with additional learning time (Chen, 2013). The approach enhances student engagement, provides collaborative learning opportunities, and improves overall learning experiences [16]. Students show increased attention, confidence, and satisfaction compared to pure online learning [27]

However, both approaches face similar challenges in physical education settings, including technological issues, poor internet connectivity, and limited technical literacy [22][34]. Additional obstacles include insufficient parental support, communication difficulties, and limited understanding of blended approaches [22] . Despite these challenges, both methods show promise for fostering critical thinking, significant learning experiences, and improved teacher-student relationships [17]. Continuous evaluation and improvement of these strategies across all educational levels remain necessary [34]

On the other hand, recent systematic reviews highlight increasing adoption at the undergraduate level, focusing on perceptions, learning outcomes, satisfaction, and motivation [40]. Since blended learning applications in physical education have shown positive effects on students' motor skills and cognitive understanding [31], and the flipped classroom model has demonstrated significant improvements in students' academic performance, health knowledge, and exercise skills within physical education settings [17] . An in-depth study and confirmatory factor analysis are needed.

Research Methodology

The study employed a descriptive, inferential, and exploratory research design using a multi-modal approach to investigate students' attitudes, perceptions, and experiences regarding the use of blended learning and flipped classrooms in physical education courses. This design allowed the researcher to assess students' attitudes, evaluate their effectiveness, identify challenges and barriers, and gather suggestions to improve the use of these methods. The study targeted 283 students and selected 20 students for focus group discussions based on the total population of 1063 enrollees across various PE courses. This calculation assumes a 95% confidence level and a 5% margin of error. The participants must have experienced both blended learning and flipped classroom approaches in PE. Descriptive statistics summarized demographic data and responses to Likert-scale items, while paired

t-tests compared the effectiveness of the learning approaches in skill acquisition and theoretical retention. Friedman's test was used to analyze the ranking data for effectiveness, while Thematic analysis using the MAXQDA tool for qualitative data was used to identify key patterns in student attitudes and suggestions.

Profile of the Respondents

The respondents are predominantly female (90.5%), with males representing only 9.5% of the sample. Most participants are 18 years old (54.5%), followed by 19-year-olds (26.5%), while students aged 20 and above constitute a smaller portion. Academically, 89% are enrolled in the Preparatory Year Program, with fewer respondents in the First Year (8.5%) and Second Year (2.5%). In terms of physical education enrollment, PE 002 Principles of Training (54.5%) is slightly more common than PE 001 Physical Fitness & Nutrition (43%), with a small number of students taking specialized classes like volleyball, basketball, or soccer. The data reflects a strong representation of young female students in preparatory programs, with limited diversity in gender, age, and course selection.

Respondents Prior Experience in the Use of Flipped and Blended

The results indicate that a significant portion of the respondents have prior experience with technology-enhanced learning methods, with 63.5% having engaged in blended learning and 58.5% in flipped classrooms. This widespread exposure suggests that these instructional approaches are commonly integrated into their educational experiences.

When examining the subjects in which these methods were applied, academic subjects such as Math and Science were the most frequently experienced, with 85.8% of blended learning participants and 81.2% of flipped classroom participants encountering these approaches in these disciplines. Interestingly, Physical Education (PE) had a higher prevalence in flipped classrooms (35.0%) compared to blended learning (26.8%), suggesting that flipped methods may be more frequently utilized in PE instruction, potentially due to their suitability for practical, movement-based learning.

A Chi-Square test was conducted to determine whether an association exists between prior experience in blended learning and flipped classrooms. The results indicate a statistically significant relationship ($p < 0.05$), meaning that students who have experienced blended learning are more likely to have also encountered flipped classrooms. This suggests that institutions or educators implementing one method may be more inclined to integrate the other, reinforcing the complementary nature of these instructional strategies.

Additionally, the data highlights a key trend: while blended learning appears to be well-established in academic subjects, the increased adoption of flipped classrooms in PE may signal a shift toward more interactive and student-centered learning in non-traditional disciplines. This aligns with broader educational trends emphasizing flexibility and engagement through technology-driven pedagogies.

The findings highlight the considerable adoption of blended and flipped learning, particularly in academic subjects, with notable use in PE for flipped classrooms. The significant association between these two methods suggests a trend toward integrating multiple technology-enhanced learning approaches. Future research could

Further investigate their effectiveness in various disciplines and their impact on student learning outcomes, particularly in fostering active participation and enhancing subject-specific competencies.

Table 1 Student's Attitudes toward the Use of Blended Learning and Flipped Classrooms

Blended Learning Attitudes				
Indicators	% Agree/ Strongly Agree	% Disagree/Strongly Disagree	Mean	SD
Flexibility in managing schedule	78.50	21.50	3.42	0.89
Interest in enrolling in BL PE courses	70.00	30.00	3.21	1.02
Comfort with online platforms for PE	75.50	24.50	3.35	0.95
Online components add value	68.50	31.50	3.18	1.10
BL keeps me more engaged vs. in-person	62.00	38.00	3.02	
Flipped Classroom Attitudes				
Indicators	% Agree/ Strongly Agree	% Disagree/Strongly Disagree	Mean	SD
FC can be effectively applied to PE	83.00	17.00	3.55	0.82
FC allows more interactive/hands-on learning	80.50	19.50	3.48	0.91
Pre-class videos improve in-class performance	73.50	26.50	3.30	1.02
FC encourages deeper engagement during class	77.00	23.00	3.40	0.97
FC allows learning at own pace	70.50	29.50	3.25	1.08
Satisfaction if BL is implemented	72.00	28.00	3.28	1.05

Students generally exhibit positive attitudes toward both blended learning and flipped classrooms in PE, though flipped classrooms are perceived as more effective. A majority agrees that blended learning offers flexibility (78.5% agree/strongly agree) and comfort with technology (75.5%), but only 62% find it more engaging than traditional classes. In contrast, 83% believe flipped classrooms are effective for PE, with 80.5% praising their ability to foster interactive, hands-on learning. Statistical comparisons (paired t-tests) confirmed that flipped classrooms scored significantly higher than blended learning in engagement (mean difference = 0.38, $p < 0.001$) and perceived effectiveness (mean difference = 0.27, $p < 0.001$). Students highlighted that pre-class videos in flipped classrooms improved in-class performance (73.5% agreement) and allowed self-paced learning (70.5%).

However, a minority (20–30%) expressed skepticism, particularly about blended learning's engagement value and the reliance on pre-class preparation in flipped models. Attitudes were strongly influenced by **pr**ior experience and comfort with technology: students comfortable with online platforms were more likely to endorse blended learning ($r = 0.72$), while those with flipped classroom experience rated its effectiveness higher ($r = 0.65$). These findings suggest flipped classrooms align better with PE's practical demands; they enhance student motivation, academic achievement, and participation [33]. Blended learning's success hinges on addressing engagement gaps through interactive design. Institutions should prioritize training for technology-resistant students and refine pre-class resources to maximize both models' potential.

Table 2 Effectiveness of Blended Learning and Flipped Classroom Approaches in Improving Learning Outcomes

BLENDED LEARNING				
Indicators	% Agree/ Strongly Agree	% Disagree/Strongly Disagree	Mean	SD
Online components help acquire new physical skills more effectively than traditional methods	65.5	34.5	3.06	1.12
BL helps remember theoretical knowledge better than traditional methods	68.0	32.0	3.10	1.08
BL effectively applies theoretical knowledge to physical performance	62.5	37.5	2.98	1.14
Online materials make it easier to understand concepts before practicing them	72.0	28.0	3.20	1.03
BL allows effective interaction with instructors for feedback/clarification	66.5	33.5	3.05	1.15
FLIPPED CLASSROOM				
Indicators	% Agree/ Strongly Agree	% Disagree/Strongly Disagree	Mean	SD
Retain theoretical knowledge better through pre-class online lessons	74.5	25.5	3.24	0.89
Apply theoretical knowledge to physical performance during class activities	68.0	32.0	3.12	0.94
Pre-class materials prepare me better for practical in-class activities	70.5	29.5	3.18	0.97
Effective interaction with instructors for feedback on practical skills	65.5	34.5	3.05	1.02
Acquire new physical skills more effectively than traditional methods	67.0	33.0	3.08	1.06

Students perceive both blended learning and flipped classrooms as moderately effective for PE, though their strengths differ. Blended learning excels in preparatory conceptual understanding, with 72% of students agreeing that online materials help them grasp concepts before practice (Mean = 3.20). However, it lags in applying theory to physical performance, with only 62.5% agreement (Mean = 2.98), suggesting challenges in bridging online content with hands-on execution.

In contrast, flipped classrooms outperform BL in theoretical retention (74.5% agreement, Mean = 3.24) and skill acquisition (67% vs. BL's 65.5%), likely due to FC's structured pre-class preparation and in-class focus on practice. Both methods share a critical weakness: instructor interaction scored lowest (BL = 66.5%, FC = 65.5%), indicating students desire more personalized feedback. While FC's hands-on structure aligns better with PE's demands, BL's flexibility appeals to learners needing self-paced theory review. To maximize effectiveness, institutions could combine BL's preparatory resources with FC's interactive class time, while enhancing instructor engagement through real-time feedback tools or hybrid discussion forums. Since blended and flipped learning approaches are transforming education by shifting from traditional teacher-centered instruction to student-driven learning [23], addressing these gaps could elevate both models from moderately to highly effective in PE contexts.

Table 3 Challenges and Barriers Students Experience in Implementing Blended Learning and Flipped Classrooms

Challenges/Barriers	% Agree/ Strongly Agree	% Disagree/Strongly Disagree	Mean	SD
Difficulty staying motivated with online components (BL)	58.5	41.5	2.89	1.09

Struggling to understand pre-class materials (FC)	54.0	46.0	2.82	1.04
Overwhelmed by online workload before in-class activities (BL/FC)	51.5	48.5	2.75	1.12
Reduced participation due to lack of physical interaction in online components (BL)	48.0	52.0	2.68	1.18
Technical difficulties (e.g., poor internet, access issues) (BL)	49.5	50.5	2.71	1.23

Students encounter significant challenges in both blended learning and flipped classrooms, with motivation (58.5% agree/strongly agree) and pre-class material comprehension (54%) emerging as the most prevalent barriers. Over half (51.5%) feel overwhelmed by the online workload required before in-person activities, while nearly half report that reduced physical interaction in online components hinders full participation (48%) and face technical difficulties like poor internet access (49.5%). These issues are amplified in PE due to its hands-on nature, where the lack of kinesthetic engagement in online tasks disrupts skill development. Technical barriers also disproportionately affect students with limited resources, as seen in the high variability (SD = ±1.23) in responses. To address these challenges, institutions must redesign pre-class materials for clarity, integrate interactive elements to sustain motivation, and balance online workloads with practical goals. Prioritizing offline resources and hybrid interaction models could mitigate access gaps and align digital tools with PE's physical demands, fostering more equitable and effective learning experiences. Despite these obstacles, blended and flipped learning models present opportunities for creating more inclusive, engaging, and future-ready educational environments [23].

Table 4 Overall Rankings across Dimensions

Physical Skills Acquisition	Average Rank	Rank 1 Count	Rank 2 Count	Rank 3 Count	Most Common Rank	Friedman Test Statistic	p-value	Interpretation
Blended Learning	2.08	43	63	56	2			
Flipped Classroom	2.05	29	96	37	2	7.79	0.02035	Significant Difference
Traditional Face-to-Face	2.27	37	44	81	3			
Theoretical Knowledge Retention	Average Rank	Rank 1 Count	Rank 2 Count	Rank 3 Count	Most Common Rank	Friedman Test Statistic	p-value	Interpretation
Blended Learning	2.12	57	70	83	3			
Flipped Classroom	2.12	39	107	64	2	0.719	0.698	No significant difference between the methods
Traditional Face-to-Face	2.20	52	65	93	3			

Theoretical Knowledge To practical Skills	Average Rank	Rank 1 Count	Rank 2 Count	Rank 3 Count	Most Common Rank	Friedman Test Statistic	p-value	Interpretation
Blended Learning	2.114	58	70	82	3			
Flipped Classroom	2.100	34	121	55	2	2.928	0.231	No significant difference
Traditional Face-to-Face	2.248	46	66	98	3			
Learning	Average	Rank 1	Rank 2	Rank 3	Most Common	Friedman	p-value	Interpretation

Flexibility	Rank	Count	Count	Count	Rank	Test Statistic		
Blended Learning	2.162	69	101	84	3			
Flipped Classroom	2.100	34	121	55	2	0.307	0.858	No significant difference
Traditional Face-to-Face	2.248	46	66	98	3			

Overall Satisfaction	Average Rank	Rank 1 Count	Rank 2 Count	Rank 3 Count	Most Common Rank	Friedman Test Statistic	p-value	Interpretation
Blended Learning	1.95	91	123	86	2			
Flipped Classroom	1.84	98	120	82	2	18.673	0.00008	Significant difference
Traditional Face-to-Face	2.21	61	107	132	3			
Feedback Effectiveness	Average Rank	Rank 1 Count	Rank 2 Count	Rank 3 Count	Most Common Rank	Friedman Test Statistic	p-value	Interpretation
Blended Learning	2.01	82	135	83	2			
Flipped Classroom	1.82	103	112	85	2	15.324	0.00047	Significant difference
Traditional Face-to-Face	2.17	65	103	132	3			
Social Interaction	Average Rank	Rank 1 Count	Rank 2 Count	Rank 3 Count	Most Common Rank	Friedman Test Statistic	p-value	Interpretation
Blended Learning	1.97	89	125	86	2			
Flipped Classroom	1.89	95	121	84	2	8.947	0.0011	Significant difference
Traditional Face-to-Face	2.14	66	104	130	3			

A comprehensive analysis of teaching methods reveals distinct patterns of effectiveness across different educational dimensions. The study examined Traditional Face-to-Face, Blended Learning, and Flipped Classroom approaches, finding significant differences in several key areas while noting parity in others. Recent studies have explored the effectiveness of blended and flipped learning compared to traditional teaching methods [35]. Both blended and flipped learning strategies significantly improved creative thinking skills in tenth-grade science students, with flipped learning showing superior results. Similarly, a review of 36 studies across various disciplines, concluding that blended learning was more effective than traditional methods in 25 cases, enhancing academic achievement and critical thinking skills[15] .

However, in this study, several areas showed no significant differences between teaching methods. Theoretical knowledge retention (p = 0.698) demonstrated remarkable parity, with all methods achieving similar effectiveness (Face-to-Face: 2.20, Blended Learning: 2.12, Flipped Classroom: 2.12). The transfer of theoretical knowledge to practical skills (p = 0.231) also showed comparable effectiveness across methods, though Face-to-Face maintained a slight edge (2.248) over Blended Learning (2.114) and Flipped Classroom (2.100). Learning flexibility demonstrated the most similarity among methods (p = 0.858), with minimal variation in average ranks (2.248 to 2.100), suggesting all approaches offer comparable adaptability to student needs.

On the other hand, four dimensions were identified where teaching methods showed statistically significant differences. Overall satisfaction emerged as the most distinctly differentiated aspect (p = 0.00008), with Traditional Face-to-Face instruction leading substantially (average rank 2.21) compared to Blended Learning (1.95) and Flipped Classroom (1.84). This preference was particularly evident in the high number of top rankings (132 respondents) assigned to Face-to-Face instruction. Similarly, feedback effectiveness showed significant variation (p = 0.00047), with Face-to-Face methods again dominating (average rank 2.17) and demonstrating clear superiority through 132 high rankings compared to Flipped Classroom's 85. Social interaction followed this pattern (p = 0.0011), with Face-to-Face instruction (average rank 2.14) significantly outperforming other methods, garnering 130 high rankings and establishing its effectiveness in fostering interpersonal engagement. Physical skills acquisition also showed significant differences (p = 0.02035), with Face-to-Face instruction (average rank 2.27) preferred over alternatives, demonstrated by 81 top rankings compared to Flipped Classroom's 37.

Clear patterns emerged in the ranking distributions across methods. Traditional Face-to-Face instruction consistently received more top

rankings (Rank 3) and led in six out of seven dimensions, showing particular strength in aspects requiring direct interaction. Blended Learning typically occupied the middle ground, showing more balanced rank distributions and performing particularly well in flexibility and theoretical knowledge areas. The Flipped Classroom approach predominantly received middle rankings (Rank 2), demonstrating strength in theoretical aspects but showing lower effectiveness in interaction-heavy dimensions.

These findings suggest a clear hierarchy in method effectiveness, with Face-to-Face instruction showing superiority in interactive aspects, Blended Learning offering consistent moderate effectiveness, and Flipped Classroom excelling in specific theoretical applications. The strongest statistical differences appeared in social and interactive dimensions, while theoretical knowledge transfer and flexibility showed method parity. This pattern indicates that while Face-to-Face instruction remains most effective for interactive learning, all methods prove viable for theoretical knowledge transfer, with Blended Learning offering perhaps the best compromise between traditional and modern approaches.

From a practical implementation perspective, these results suggest that educational institutions should consider a strategic approach to deploying these methods. Face-to-face instruction should be prioritized for skills requiring direct interaction and immediate feedback. Blended Learning can serve as an effective compromise for balanced course delivery, while Flipped Classroom approaches may be most appropriate for theory-heavy content. To optimize these approaches, institutions should focus on enhancing social interaction in virtual methods, strengthening feedback mechanisms in Flipped Classroom settings, and maintaining flexibility while maximizing engagement across all teaching modalities.

This analysis ultimately reinforces the importance of matching teaching methods to specific learning objectives while highlighting opportunities for improving each approach's effectiveness in areas where they currently show weakness. The data suggests that a nuanced, multi-method approach to education, carefully aligned with learning objectives and student needs, may offer the most effective path forward in modern education.

Table 5 Students' Suggestions on the Improvement They Want in Physical Education Classes

Theme	Count	Description	Key Examples
No Suggestions / Satisfied	42	The most common response category indicates satisfaction with current methods or no specific suggestions for improvement.	*"Everything is good."* *"No suggestions."* *"Thank you."*
Preference for Traditional Learning	28	Strong preference for in-person instruction, citing better focus and engagement.	*"Face-to-face is always going to be the best."* *"I prefer face-to-face because it makes me more focused."* *"Don't make PE classes online, please."*
Technology Integration	24	Suggestions for incorporating videos, apps, and digital resources to enhance learning.	*"Short instructional videos."* *"Watching a video before class of the activity we are going to do."* *"Use of technology."*
Interactive Content	16	Requests for engaging activities and interactive elements.	*"Class activities after each lesson, like a Kahoot game."* *"More demonstration videos during class make it more interactive."* *"Group learning by working with classmates."*
Structural Improvements	12	Suggestions for better organization, pacing, and workload management.	*"Less hardcore activities because it becomes overwhelming."* *"Time management."* *"Organized materials that are clear and easy to understand."*

The thematic analysis of student suggestions regarding blended learning and flipped classrooms in Physical Education revealed several distinct patterns. The most prevalent response category, comprising 42 instances, was "No Suggestions/Satisfied," where students either expressed contentment with current methods or provided no specific feedback for improvement. This was followed by a significant preference for traditional learning, with 28 students strongly advocating for face-to-face instruction, citing better focus and engagement in physical classroom settings. Technology integration emerged as the third most common theme, with 24 students suggesting the incorporation of instructional videos, digital resources, and online tools to enhance their learning experience.

Interactive content formed another significant theme, with 16 students requesting more engaging activities, such as educational games, interactive demonstrations, and group learning opportunities. Structural improvements were suggested by 12 students, who focused on better organization of materials, improved time management, and more balanced workload distribution. The smallest but still notable category was a preference for online learning, with 8 students explicitly favoring online or blended formats, appreciating their flexibility and convenience.

These findings suggest a complex landscape of student preferences and needs, with a clear divide between traditional and digital learning approaches. While many students are satisfied with current methods, there is a strong emphasis on the importance of face-to-face instruction in physical education. However, the significant number of technology-related suggestions indicates an openness to the digital enhancement of traditional teaching methods, particularly when it comes to preparatory materials and interactive elements. This analysis highlights the importance of finding a balanced approach that maintains the benefits of traditional physical education while thoughtfully incorporating digital tools and resources to enhance the learning experience.

Summary of Findings

1. Students generally hold positive attitudes toward both blended learning and flipped classrooms in physical education (PE), though flipped classrooms are perceived as more effective overall. While both approaches are valued, flipped classrooms are favored for their practicality and engagement, whereas blended learning requires targeted improvements to boost student involvement.

2. Students perceive blended learning (BL) and flipped classrooms (FC) as moderately effective for physical education (PE), with distinct strengths and weaknesses. FC's structured practice focus makes it slightly more aligned with PE's practical demands. However, combining their strengths and improving instructor-student interaction could elevate both approaches to high effectiveness in PE contexts.

3. Students face significant challenges in both blended learning (BL) and flipped classrooms (FC) within physical education (PE), with key barriers linked to motivation, comprehension, workload, and access

4. Traditional face-to-face instruction is consistently ranked as the most preferred and effective method for acquiring physical skills, likely due to real-time feedback, hands-on practice, and direct interaction with instructors.

5. Blended learning (combining online and in-person elements) is viewed as a close second to face-to-face learning, offering flexibility while maintaining moderate effectiveness for both skill acquisition and theoretical retention.

6. Flipped classrooms (pre-class online learning followed by in-person practice) are perceived as the least effective for physical skill development, potentially due to challenges in independently learning practical skills before applying them in class.

7. No significant differences exist in perceived effectiveness among the three methods for theoretical retention or flexibility, suggesting all approaches can work well depending on implementation.

8. Face-to-face learning is rated highest for social interaction and feedback quality, with blended and flipped models seen as less effective in fostering these areas.

9. Students strongly prefer traditional instruction for overall learning satisfaction, though blended and flipped methods remain viable alternatives when in-person learning isn't fully feasible.

10. Statistical tests confirm significant differences in satisfaction, feedback effectiveness, and social interaction across methods, with face-to-face consistently outperforming blended and flipped approaches.

11. Flexibility is similarly rated across all methods, indicating that blended and flipped models successfully accommodate varied schedules without compromising perceived value.

12. While face-to-face instruction remains the gold standard for skill-based and interactive learning, blended methods offer a flexible compromise. Flipped classrooms, although less favored, may still suit contexts that prioritize pre-class theoretical preparation. Success depends on aligning the method with course goals—hands-on skills favor traditional teaching, while theory-heavy subjects might benefit from blended or flipped approaches.

13. Traditional face-to-face instruction remains central to PE due to its hands-on, social, and kinesthetic advantages. Students are open to targeted digital enhancements but want these to complement, not replace, in-person practice.

Conclusion

Physical education (PE) fundamentally relies on hands-on, social, and kinesthetic engagement, solidifying traditional face-to-face (F2F) instruction as the cornerstone for skill acquisition, real-time feedback, and student satisfaction. While flipped classrooms (FC) and blended learning (BL) present innovative alternatives, their efficacy depends on context. Flipped classrooms excel in theoretical retention, engagement, and applying theory to practice, making them ideal for pre-class preparation (e.g., anatomy lessons) paired with structured in-person activities, though they falter in guiding independent physical skill development. Blended learning

offers flexibility and robust preparatory resources for foundational knowledge but struggles to bridge theory with physical execution, necessitating interactive redesigns to boost engagement. Face-to-face instruction remains unparalleled for mastering physical skills, fostering social interaction, and delivering immediate feedback, securing its status as the most preferred method. To optimize outcomes, institutions should adopt hybrid models that merge F2F's practical strengths with digital tools like pre-class videos or gamified theory modules while strategically deploying each approach: F2F for skill drills, FC for theory-practice integration, and BL for self-paced learning. Addressing challenges—such as streamlining pre-class workloads, improving tech access, and integrating real-time feedback tools (e.g., wearable sensors)—can mitigate barriers in digital methods. Additionally, enhancing instructor interaction through video critiques or virtual office hours can replicate F2F's relational benefits. Ultimately, digital models like BL and FC should complement, not replace, in-person instruction, aligning with specific learning goals: F2F for skill mastery, BL for flexibility, and FC for theory application. Success requires prioritizing equitable access, instructor training, and student feedback to harmonize these methods within PE's physically driven framework.

Recommendations

1. Blended learning needs enhanced interactive design to address engagement gaps, institutions should provide training for students resistant to technology.

2. A hybrid approach should combine blended learning's (BL) preparatory resources—such as online theory modules—with flipped classrooms' (FC) interactive, hands-on class time to capitalize on the strengths of both models to enhance instructor engagement, institutions could integrate real-time feedback tools like wearable technology for instant skill correction during practical sessions and implement hybrid discussion forums where students clarify theoretical concepts before or after class. Additionally, to address skill-practice gaps, BL content should be redesigned to explicitly link theory to physical execution, such as pairing video demonstrations with guided practice prompts that students can apply in real-world PE activities.

3. Addressing these through redesigned materials, equitable resource distribution, and hybrid interaction strategies could create more inclusive and effective learning experiences tailored to PE's physical demands.

4. Institutions should focus on the strategic integration of these methods, addressing their limitations through improved design, equity-focused support, and continuous feedback loops. This balanced approach ensures adaptability without compromising the quality of hands-on education.

5. PE programs should prioritize in-person skill development while selectively integrating technology to address diverse learner needs without compromising engagement.

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