MODERN FUTSAL COACHING: SCIENTIFIC CHARACTERISTICS AND EDUCATIONAL IMPLICATIONS

Trinh Dinh Duong

University of Sport Ho Chi Minh City, Ho Chi Minh City, Vietnam

Abstract

The rapid development of futsal has increased the demand for specialized coaching education and scientifically grounded training methodologies. Modern futsal is characterized by high-intensity physiological demands, rapid tactical transitions, constrained-space technical execution, and increasing integration of sport science and digital technology into coaching practice. These developments have transformed futsal coaching toward evidence-informed and multidimensional professional practice. However, coach education systems in many countries still rely heavily on traditional football-oriented training models.

This paper examines the major scientific characteristics of modern futsal coaching and their implications for undergraduate coach education through a narrative literature review. The review identifies several scientific characteristics of modern futsal, including high-intensity intermittent activity, transition-oriented tactical structures, perceptual-cognitive demands, performance analysis integration, and technology-enhanced coaching environments.

The paper argues that undergraduate futsal coach education should move beyond traditional content-based instruction toward competency-based, interdisciplinary, and practice-oriented educational models. Greater attention should also be given to performance analysis, sport technology, tactical cognition, and authentic professional practice within futsal coaching curricula.

The study contributes to the theoretical foundation for specialized undergraduate futsal coach education within higher education institutions.

Keywords: Futsal Coaching; Coach Education; Sport Science; Performance Analysis; Competency-Based Education; Higher Education.

1. Introduction

Futsal has experienced significant global development over the past two decades and is increasingly recognized as an independent sport with distinctive tactical, technical, physiological, and organizational characteristics. The expansion of international competitions organized by Fédération Internationale de Football Association (FIFA) and the growing professionalization of domestic futsal leagues have contributed to increasing scientific interest in futsal performance and coaching methodology. Unlike traditional outdoor football, futsal is characterized by reduced playing space, continuous transitions, high-intensity actions, and rapid decision-making under pressure (Barbero-Alvarez et al., 2008; Spyrou et al., 2020).

Previous studies have shown that modern futsal involves frequent high-intensity intermittent actions, repeated accelerations and decelerations, and constrained-space technical execution (Castagna et al., 2009; Naser et al., 2017). Physiological research indicates that elite futsal players frequently perform at near-maximal physiological intensity, while tactical studies emphasize positional rotation, coordinated pressing systems, fluid spatial organization, and transition efficiency (Travassos et al., 2012). These developments have reinforced the multidimensional nature of modern futsal coaching.

The scientific evolution of futsal has also transformed coaching methodologies from predominantly experience-based approaches toward evidence-based and technology-supported practice. Modern coaching increasingly integrates exercise physiology, performance analysis, sport psychology, tactical analytics, and digital technologies into athlete preparation and match management (Garganta, 2009; Hughes & Bartlett, 2002). Consequently, the professional role of futsal coaches now extends substantially beyond technical instruction alone.

Despite these developments, futsal coach education in many countries remains insufficiently specialized. Existing educational programs are often adapted from conventional outdoor football coaching models and continue to

provide limited attention to performance analysis, tactical cognition, sport technology, and interdisciplinary coaching competencies (Cushion et al., 2003; Nelson et al., 2006). In many higher education institutions, futsal is still treated as a minor component within broader football curricula rather than as an independent academic specialization.

Recent developments in higher education have increasingly emphasized competency-based learning and authentic professional practice in coach education (Gilbert & Trudel, 2004). Therefore, this paper aims to analyze the major scientific characteristics of modern futsal coaching and examine their implications for undergraduate coach education. By synthesizing literature from sport science, coaching research, and higher education studies, the paper seeks to establish a conceptual foundation for specialized undergraduate futsal coach education.

2. Review Approach

This study employed a narrative literature review approach to examine the scientific characteristics of modern futsal coaching and their implications for undergraduate coach education (Baumeister & Leary, 1997; Snyder, 2019).

Relevant literature was identified through major academic databases, including Scopus, Web of Science, Google Scholar, and SPORTDiscus. The review focused primarily on peer-reviewed journal articles, academic books, conference proceedings, and official coaching and educational documents related to futsal coaching, sport science, tactical analysis, performance analysis, coach education, and sport pedagogy.

The literature search included keywords such as “futsal coaching,” “futsal physiology,” “performance analysis in futsal,” “tactical analysis in futsal,” “coach education,” and “competency-based coach education.” Official FIFA documents and coaching materials were also consulted to contextualize contemporary coaching trends and professional requirements.

The selected literature was analyzed thematically, with particular attention to physiological demands, tactical complexity, technical execution, perceptual-

cognitive performance, technology integration, and interdisciplinary coaching practice. Rather than statistically aggregating empirical findings, the review aimed to provide conceptual integration and theoretical interpretation of existing literature.

Priority was given to studies published in peer-reviewed international journals and to literature addressing elite or high-performance futsal environments. Seminal studies in coaching science and sport pedagogy were also included where directly relevant to the conceptual framework of the review.

3. Scientific Characteristics of Modern Futsal Coaching

3.1. High-Intensity Physiological Demands

One of the defining scientific characteristics of modern futsal is its exceptionally high physiological intensity. Due to the reduced playing area and continuous player involvement, futsal requires repeated high-intensity actions with limited recovery time. Previous studies have shown that futsal competition involves frequent accelerations, decelerations, sprinting actions, directional changes, and explosive movements performed under intermittent conditions (Barbero-Alvarez et al., 2008; Castagna et al., 2009).

Research on elite futsal players has demonstrated that heart rate responses during matches frequently approach near-maximal physiological intensity, indicating substantial physiological stress throughout competition (Barbero-Alvarez et al., 2008). Spyrou et al. (2020) further concluded that futsal imposes substantial aerobic and anaerobic demands, requiring players to combine repeated sprint ability with rapid recovery capacity. Unlike traditional outdoor football, futsal players remain continuously involved in offensive and defensive transitions because of the compact court dimensions and limited number of players.

These physiological demands have significantly influenced modern coaching methodologies. Contemporary conditioning approaches increasingly emphasize repeated sprint ability, agility, intermittent endurance, workload management, fatigue monitoring, and injury prevention. In addition, athlete

monitoring technologies such as heart rate systems and workload analysis software are increasingly used to support evidence-based coaching practice (Spyrou et al., 2020). As a result, coaching in modern futsal has become progressively data-informed and scientifically supported.

3.2. Tactical Complexity and Transition-Oriented Play

Modern futsal is characterized by substantial tactical complexity arising from rapid transitions, constrained spatial environments, and continuous player interaction. Tactical organization therefore requires high levels of collective coordination, positional flexibility, and situational decision-making.

Modern futsal systems increasingly emphasize coordinated pressing, rapid transition from defense to attack, fluid spatial organization, compact defensive structures, and adaptive responses to opponent movement (Travassos et al., 2012). Because of the reduced playing space and accelerated game tempo, players are exposed to constant tactical pressure and must make rapid decisions under severe temporal constraints.

This tactical complexity has transformed the role of the futsal coach from a primarily instructional figure into a designer of representative learning environments capable of reproducing authentic game constraints. Such developments are consistent with ecological dynamics and game-based pedagogical approaches, which emphasize learning through interaction with realistic performance environments (Davids et al., 2013).

The increasing tactical sophistication of futsal has also strengthened the importance of performance analysis in coaching practice. Video analysis systems and tactical coding technologies are widely used to evaluate transition behavior, pressing effectiveness, positional organization, and collective tactical adaptation during competition (Hughes & Bartlett, 2002).

3.3. Technical Execution Under Spatial and Temporal Constraints

Technical execution in futsal differs substantially from outdoor football because skills must be performed rapidly within highly constrained spatial environments. The reduced playing area and continuous defensive pressure

require players to execute technical actions with exceptional speed, precision, and adaptability.

Studies have shown that futsal players perform considerably more ball contacts and technical interactions per unit of time than outdoor football players (Naser et al., 2017). Consequently, modern futsal prioritizes technical precision within dynamic tactical situations. Players are expected not only to master technical skills but also to adapt technical execution continuously according to contextual constraints during competition. Technical performance consequently becomes closely connected to tactical perception and situational awareness.

Traditional approaches based on repetitive isolated drills have increasingly been challenged by ecological and constraints-led perspectives emphasizing contextualized learning environments (Davids et al., 2013). As a result, modern futsal coaching increasingly adopts representative task design, small-sided games, and game-based learning methodologies capable of integrating technical, tactical, cognitive, and perceptual demands simultaneously.

3.4. Cognitive and Perceptual Demands

Modern futsal imposes substantial cognitive and perceptual demands on players because of the speed and complexity of tactical interaction. Athletes are required to perceive environmental information continuously, anticipate opponent behavior, recognize tactical patterns, and make rapid decisions under temporal pressure.

Research in sport cognition has highlighted the importance of perceptual-cognitive expertise in high-performance team sports (Williams & Ford, 2008). In futsal, the reduced playing space and accelerated game tempo further intensify these cognitive requirements.

Consequently, modern futsal coaching increasingly incorporates decision-making training, perceptual awareness exercises, situational problem-solving, and tactical cognition activities into training programs. Rather than emphasizing

memorization of fixed tactical solutions, contemporary coaching approaches increasingly prioritize tactical adaptability and adaptive cognition.

As a result, modern futsal coaching has become progressively interdisciplinary, integrating concepts from psychology, neuroscience, motor learning, and tactical pedagogy into athlete development processes.

3.5. Performance Analysis and Technology Integration

Technological innovation has become one of the most influential drivers of change in modern futsal coaching. Advances in digital technology, video analysis systems, and statistical software have transformed how coaches evaluate performance and organize training processes.

Performance analysis is now widely used in elite futsal to evaluate transition efficiency, positional organization, pressing behavior, shooting effectiveness, and player workload patterns (Hughes & Bartlett, 2002). Video-based tactical analysis has also become increasingly integrated into match preparation and post-match evaluation.

In addition, athlete monitoring technologies and digital databases are increasingly used to manage training intensity, monitor fatigue, and support injury prevention strategies (Spyrou et al., 2020). Consequently, modern futsal coaches are increasingly expected to understand data interpretation, video coding, and analytical evaluation in addition to traditional coaching competencies.

These developments have contributed to the emergence of data-informed coaching cultures within elite futsal environments.

3.6. Interdisciplinary Nature of Modern Futsal Coaching

The scientific development of futsal has transformed coaching into a highly interdisciplinary professional activity. Contemporary coaching environments increasingly involve collaboration among specialists in exercise physiology, biomechanics, sport psychology, rehabilitation science, and performance analysis.

Modern coaches are therefore expected not only to provide technical instruction but also to coordinate scientific expertise, support athlete development, and manage complex performance environments. Research on coach development has also emphasized the importance of reflective learning, communication skills, collaborative problem-solving, and continuous professional adaptation in effective coaching practice (Cushion et al., 2003; Gilbert & Trudel, 2004).

This evolution reinforces the need for undergraduate futsal coach education programs capable of preparing future coaches for scientifically integrated and collaborative professional environments.

4. Educational Implications for Undergraduate Futsal Coach Education

4.1. The Need for Specialized Undergraduate Futsal Coach Education

The scientific evolution of modern futsal has created professional demands that cannot be adequately addressed through traditional football coach education models. Modern futsal coaching requires integrated understanding of physiology, tactical analysis, sport psychology, performance technology, and pedagogical methodology. Consequently, undergraduate programs must move beyond fragmented technical instruction toward comprehensive professional preparation aligned with the realities of modern futsal environments.

In many higher education institutions, futsal remains positioned as a supplementary component within broader football curricula rather than as an independent specialization. This structure limits opportunities for students to develop competencies related to futsal-specific tactical systems, performance analysis, and contextualized technical instruction. As a result, graduates may experience difficulties adapting to the scientific and organizational demands of modern futsal coaching.

Research on coach development emphasizes that coaching expertise emerges through the integration of theoretical knowledge, reflective practice, contextual learning, and professional experience rather than isolated technical

instruction alone (Cushion et al., 2003; Nelson et al., 2006). Accordingly, undergraduate futsal coach education should be structured as a specialized professional formation process integrating scientific knowledge with authentic coaching practice.

The increasing professionalization of futsal also reinforces the importance of aligning coach education with contemporary sport systems and labor market demands. Higher education institutions are increasingly expected to prepare graduates capable of operating within technologically integrated and evidence-informed coaching environments.

4.2. Competency-Based Curriculum Design

The scientific characteristics of modern futsal strongly support the adoption of competency-based approaches in undergraduate coach education. Competency-based education emphasizes the development of integrated professional capabilities combining knowledge, practical skills, decision-making ability, and professional attitudes within authentic occupational contexts (Mulder, 2014).

Within futsal coach education, competency development should include futsal-specific tactical expertise, training organization, athlete monitoring, pedagogical communication, performance analysis, sport technology application, and professional ethics. Such an approach enables educational programs to respond more effectively to the multidimensional demands of modern coaching environments.

The shift toward competency-based curriculum design also reflects broader transformations associated with Outcome-Based Education (OBE), which has become increasingly influential in higher education reform. OBE frameworks emphasize alignment among learning outcomes, teaching methods, learning activities, and assessment systems (Biggs & Tang, 2011). In futsal coach education, this alignment is particularly important because coaching competence depends heavily on the application of knowledge within dynamic practical environments.

Competency-based curriculum design further supports the integration of theory and practice through coaching practicums, field experiences, performance analysis projects, and supervised training sessions. Such experiences are essential because coaching expertise is strongly shaped by contextual interaction and reflective professional practice (Gilbert & Trudel, 2004).

Moreover, competency-based frameworks facilitate closer alignment between university education and professional coaching requirements by establishing clearer professional standards associated with modern futsal coaching.

4.3. Integration of Sport Science into Curriculum Structure

The multidimensional nature of modern futsal coaching requires undergraduate curricula to incorporate broader sport science content than traditionally included in coach education programs. Modern coaches increasingly rely on scientific knowledge to support athlete development, training optimization, injury prevention, and performance evaluation.

Exercise physiology represents a central scientific foundation for futsal coaching education because of the sport's high-intensity intermittent characteristics. Undergraduate programs should therefore provide understanding of energy systems, fatigue mechanisms, recovery processes, workload monitoring, and conditioning principles specific to futsal performance.

Biomechanics, motor learning, and sport psychology are also increasingly important within futsal coach education. These fields contribute to technical instruction, movement efficiency, decision-making, emotional regulation, and skill acquisition. Performance analysis has likewise emerged as a critical component of coaching science, as contemporary coaches frequently use video analysis systems and statistical interpretation to evaluate team organization and individual performance.

The growing importance of technology further reinforces the need for technological literacy within coach education. Students should be introduced to

athlete monitoring systems, video analysis platforms, and data interpretation tools increasingly used in elite coaching practice.

Integrating sport science into curriculum structure should not simply involve adding theoretical subjects. Instead, scientific knowledge must be connected directly to coaching practice through applied learning environments and contextualized problem-solving activities. Such integration reflects the broader scientification of contemporary coaching practice.

4.4. Practice-Based and Experiential Learning

The professional nature of coaching requires undergraduate futsal education to prioritize experiential and practice-based learning approaches. Coaching competence develops not only through theoretical study but also through interaction with authentic coaching situations and reflective professional practice.

Experiential learning theories emphasize that professional expertise emerges through cycles of action, reflection, evaluation, and adaptation (Kolb, 1984). Within futsal coach education, this perspective highlights the importance of practical coaching experiences capable of exposing students to the complexity of real performance environments.

Practice-based learning may include supervised coaching practicums, match observation, tactical analysis assignments, athlete assessment activities, and participation in team management processes. These experiences allow students to connect theoretical knowledge with practical coaching challenges while developing professional decision-making abilities.

Contemporary pedagogical approaches increasingly support authentic learning environments through small-sided games, situational coaching tasks, scenario-based learning, and collaborative projects. These approaches help students develop adaptive coaching competencies relevant to modern futsal practice.

Reflective learning also represents an important component of coach development. Undergraduate programs should therefore encourage students to

engage in reflective journals, coaching portfolios, video-assisted reflective analysis, peer discussions, and performance evaluations as part of their professional formation.

Furthermore, collaboration between universities and external sport organizations can strengthen experiential learning opportunities by exposing students to authentic coaching environments and contemporary professional practice.

4.5. Assessment and Evaluation of Coaching Competence

The complexity of modern futsal coaching requires assessment systems capable of evaluating integrated professional competence rather than isolated theoretical knowledge alone. Traditional written examinations may be insufficient for measuring practical coaching ability, tactical decision-making, communication skills, and contextual problem-solving capacity.

Contemporary assessment approaches increasingly emphasize authentic evaluation methods aligned with competency-based education principles (Biggs & Tang, 2011). Within futsal coach education, assessment systems should therefore incorporate practical coaching demonstrations, tactical analysis projects, training design assignments, video-based evaluations, and field-based performance assessment.

Rubric-based assessment frameworks may provide greater consistency and transparency in evaluating coaching competence across multiple dimensions of professional performance, including instructional communication, tactical organization, session management, athlete interaction, and reflective capacity.

Performance-based assessment is particularly important because coaching competence is inherently contextual and interactive. Students should therefore be evaluated within realistic coaching environments requiring them to organize training activities, respond to tactical situations, and adapt to changing performance conditions.

Self-assessment and peer evaluation may also contribute positively to coach development by encouraging reflective learning and collaborative

professional dialogue. Finally, assessment systems should remain aligned with professional coaching standards and intended learning outcomes in order to reinforce the professional orientation of undergraduate futsal coach education.

5. Discussion

The findings of this review indicate that modern futsal has evolved into a scientifically complex and multidimensional sport environment requiring increasingly sophisticated coaching competencies. The physiological intensity, tactical dynamism, cognitive demands, and technological integration characteristic of modern futsal collectively require substantial transformation in undergraduate coach education.

A major issue identified in this review is the growing gap between the scientific evolution of futsal and the structure of existing coach education programs. In many higher education institutions, futsal continues to be positioned as a supplementary component within broader football curricula, despite the increasing importance of tactical analysis, performance technology, interdisciplinary collaboration, and evidence-informed coaching practice.

The findings also reinforce broader discussions within sport pedagogy regarding the transition from content-centered education toward competency-based professional preparation. The findings also reinforce broader discussions within sport pedagogy regarding the transition from content-centered education toward competency-based professional preparation. Coaching expertise increasingly depends on the integration of theoretical understanding, contextual experience, reflective learning, and professional adaptation rather than technical instruction alone (Cushion et al., 2003; Nelson et al., 2006).

The tactical and cognitive complexity of futsal further highlights the importance of contextualized and game-based learning approaches. Ecological and constraints-led perspectives emphasize learning through interaction with realistic performance environments rather than isolated technical drills (Davids et al., 2013). Consequently, undergraduate programs should increasingly

incorporate representative tactical situations, problem-solving activities, and authentic coaching experiences.

Technological development also continues to reshape coaching practice. Performance analysis systems, athlete monitoring technologies, and digital communication platforms have become increasingly influential in training organization and tactical evaluation. As a result, technological literacy and analytical capability now represent essential dimensions of professional coach preparation.

The findings additionally reinforce the importance of experiential learning and professional collaboration in coach education. Partnerships between universities, futsal clubs, federations, and professional organizations may strengthen practical learning opportunities and improve alignment between educational programs and contemporary professional environments.

Despite its theoretical contributions, this study has several limitations. The review employed a narrative rather than systematic approach, which may involve greater subjectivity in literature selection and interpretation. In addition, international research specifically addressing futsal coach education remains relatively limited compared with broader football coaching literature.

Future research should therefore examine futsal coach education models empirically, particularly competency frameworks, curriculum structures, and practice-oriented pedagogical approaches within higher education contexts.

Overall, this review suggests that the scientific transformation of modern futsal requires corresponding innovation in undergraduate coach education. Developing specialized educational models aligned with the evidence-informed and multidimensional nature of modern futsal may contribute significantly to improving coach preparation and supporting the sustainable development of futsal within contemporary high-performance sport systems.

6. Conclusion

Modern futsal has evolved into a highly dynamic and multidimensional sport characterized by high-intensity physiological demands, rapid tactical

transitions, constrained-space technical execution, cognitive complexity, and increasing technological integration. These characteristics have transformed the professional role of futsal coaches and expanded the competencies required for effective coaching practice.

The findings of this review demonstrate that modern futsal coaching can no longer be understood solely through traditional technical instruction models. Contemporary coaches are increasingly expected to integrate knowledge from exercise physiology, sport psychology, tactical analysis, motor learning, performance analysis, and digital technology into athlete development and team management processes. Consequently, undergraduate futsal coach education requires substantial curricular and pedagogical transformation aligned with contemporary professional practice.

This study highlights the importance of competency-based curriculum design in futsal coach education. Educational programs should emphasize integrated professional competencies combining theoretical understanding, practical coaching ability, contextual decision-making, technological literacy, and reflective professional practice. Particular attention should be given to experiential learning, authentic coaching environments, interdisciplinary integration, and evidence-informed pedagogical approaches.

The review also emphasizes the relevance of OBE and practice-oriented learning models in supporting professional coach preparation. Aligning learning outcomes, teaching strategies, assessment systems, and practical experiences may strengthen the capacity of undergraduate programs to prepare future coaches for scientifically complex sport environments.

Although conceptual in nature, this study contributes to the theoretical foundation of specialized undergraduate futsal coach education by synthesizing the major scientific characteristics of modern futsal and examining their educational implications. The findings may therefore provide useful guidance for curriculum developers, sport educators, higher education institutions, and researchers interested in futsal coach education.

Future research should continue investigating competency frameworks, curriculum structures, pedagogical approaches, and assessment systems appropriate for undergraduate futsal coaching programs. Empirical evaluation of specialized futsal coach education models will be particularly important for supporting evidence-based educational development in this field.

Ultimately, strengthening undergraduate futsal coach education may contribute significantly to the professionalization of coaching practice, the development of high-quality human resources, and the sustainable development of futsal within contemporary high-performance sport systems.

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