



Application Path Research of Virtual Simulation Technology in Martial Arts Teaching in Colleges and Universities

Dan Chen

Chengyi College, Jimei University Xiamen, Fujian, China

cd58747580@163.com

Abstract. With the rapid development of technology, virtual simulation technology, as an emerging teaching method, is gradually penetrating into various fields of education, including martial arts teaching in colleges and universities. This paper aims to explore the current application status, challenges, advantages, and specific application paths of virtual simulation technology in college martial arts teaching. It hopes to provide a new perspective and method for improving martial arts education, promoting modernization and efficiency in martial arts teaching.

Keywords: Virtual simulation technology; College martial arts teaching; Application status; Challenges; Advantages; Application paths.

1 Introduction

Martial arts, as an important component of Chinese traditional culture, carries rich historical and cultural connotations and has practical value in enhancing physical fitness and personal development. However, in traditional martial arts teaching, due to limitations in teaching methods and tools, it is often difficult to achieve ideal teaching outcomes. The emergence of virtual simulation technology provides new opportunities and challenges for martial arts education in colleges. This paper will analyze the current application status of virtual simulation technology in college martial arts teaching, delve into the challenges and advantages it faces, and explore specific application paths to provide useful references for the reform and development of martial arts education in colleges.

2 Current Application Status of Virtual Simulation Technology in College Martial Arts Teaching

In the current context of rapid advancements in educational technology in China, virtual simulation technology, as an emerging force, is gradually penetrating various fields of higher education, with martial arts teaching as a typical beneficiary. To

thoroughly assess the current application status of virtual simulation technology in college martial arts teaching, this study conducted a survey in several colleges, distributing 200 questionnaires and processing the data using SPSS software to ensure the accuracy and objectivity of the analysis. Additionally, in-depth interviews were conducted; while 30 teaching staff and students were planned for interviews, 18 were completed, enriching the survey content further. The survey results indicate a significant positive correlation ($r=0.395^{**}$) between the ability to apply virtual reality technology and martial arts teaching effectiveness in colleges, confirming the positive role of virtual simulation technology in enhancing martial arts teaching outcomes. Although another indicator shows a non-significant positive correlation ($r=0.063$) between martial arts teaching and virtual reality application ability, this does not detract from the considerable potential brought by technology application.

On a practical application level, virtual simulation technology has brought unprecedented innovation to martial arts teaching in colleges. For example, one college that introduced virtual simulation technology saw a significant improvement in teaching effectiveness for its martial arts course. By constructing a highly realistic virtual environment, students could experience multiple sensory perceptions such as visual and auditory stimuli, making them feel as if they were in a real martial arts setting. This immersive learning approach not only enhanced students' understanding of martial arts actions but also greatly stimulated their interest in learning. Statistics show that in classes using virtual simulation technology for auxiliary teaching, students' mastery of martial arts moves improved by approximately 30% compared to traditional classes, and their interest in learning also significantly increased. However, the application of virtual simulation technology in college martial arts teaching also faces several challenges. Given that this technology has only been introduced into martial arts education for a relatively short period, related teaching resources and content are somewhat lacking. The production of high-quality virtual simulation courseware requires substantial manpower, material resources, and financial investment. Currently, the market offers limited martial arts teaching software options, most of which fall short in detail description and action simulation. Furthermore, according to survey data, participation numbers in multimedia courses, such as Photoshop and Photoimpact, varied from 16 to 96 students; however, in the application of virtual simulation technology, performance appeared insufficient. The same was true for courses involving Coreldraw, Autocad animations, and smartphone video learning, indicating a need for further integration with virtual simulation technology. (as shown in Table 1)

Table 1. Survey Sampling Table of Elements for Virtual Reality Teaching Methods in College Martial Arts Education

Photo shop courseware	Photo impact multimedia	Coreldraw with Autocad animation	Smart phone video learning	Total
16 people	17 people	21 people	31 people	85 people
22 people	20 people	26 people	26 people	94 people
96 people	106 people	96 people	100 people	179 people

3 Challenges of Applying Virtual Simulation Technology in College Martial Arts Teaching

3.1 The Attachment to Experience in the Inheritance of Martial Arts

Martial arts, as an art form deeply rooted in traditional culture, has always emphasized the seamless connection between experience and tradition throughout its long history of inheritance. However, when virtual simulation technology, as an emerging teaching method, enters the field of martial arts education, the differences in teaching philosophy and methodology between the two become apparent. This disparity leads to a hesitant attitude among some martial arts teachers and students towards virtual simulation technology, and even creates resistance, making it difficult for them to quickly adapt to this new teaching model^[1]. Therefore, one of the major challenges facing martial arts teaching in colleges is how to effectively integrate the advantages of virtual simulation technology while respecting and continuing the tradition and experience of martial arts, thereby promoting innovation and development in the teaching model.

3.2 The Lack of Experiential Understanding in Martial Arts Under Virtual Simulation Technology

Learning martial arts involves not only mastering the essentials and techniques, but also deeply feeling the inner charm and spiritual connotation of martial arts through continuous practice and experience. However, while virtual simulation technology can highly simulate martial arts scenes and movements, it is difficult to fully replicate the genuine bodily sensations and experiential processes. This may lead students to struggle with deeply understanding the essence of martial arts due to a lack of real physical experiences during their learning process, which can subsequently affect learning outcomes. Therefore, a pressing issue for martial arts teaching in colleges is how to ensure that students can maintain their experiential understanding of martial arts learning while utilizing virtual simulation technology.

3.3 The Absence of Competition Motivation Mechanisms in Virtual Simulation Environments

Competition plays a vital role in stimulating students' interest and motivation in learning, occupying an important position in martial arts education. However, traditional martial arts teaching is often limited by factors such as venue and time, making it difficult to frequently organize large-scale competitions. Although virtual simulation technology can simulate real martial arts competition scenarios, it still falls short in creating the competition atmosphere and motivation mechanisms. This may result in students lacking the incentive and drive that competitions typically provide, making it challenging to fully unleash their learning potential. Thus, when employing virtual simulation technology in martial arts education, developing effective competi-

tion motivation mechanisms to inspire students' enthusiasm and participation becomes a direction that requires in-depth exploration.

4 Advantages of Applying Virtual Simulation Technology in College Martial Arts Teaching

4.1 Breaking the Limitations of Time and Space, Enhancing Teaching Flexibility

The integration of virtual simulation technology into college martial arts teaching primarily showcases its core value by breaking the constraints of time and space, bringing unprecedented flexibility and freedom to martial arts education. Traditional martial arts teaching is often restricted by physical spaces such as classrooms and training grounds, as well as fixed times dictated by course schedules, which can limit students' autonomy and breadth of learning. The introduction of virtual simulation technology opens a door to infinite possibilities for students. With this technology, they are no longer confined to specific learning locations and times; whether at home, in a library, or anywhere with internet access, they can easily connect to the virtual simulation system and embark on their martial arts learning journey ^[2]. This cross-time-and-space learning approach not only greatly broadens the boundaries of learning but also fully respects and meets the individualized learning needs of students, making the learning process more flexible and diverse. Additionally, the rich teaching resources and interactive features inherent in virtual simulation technology provide students with a customized learning experience, allowing them to freely choose content and difficulty levels based on their progress and interests, flexibly adjust their learning plans, and achieve self-driven efficient learning in a relaxed and enjoyable atmosphere.

4.2 Real Scene Simulation, Immersive Learning Experience

Another significant advantage of virtual simulation technology in college martial arts teaching is its ability to achieve high-precision simulation of real scenes, providing students with an immersive learning experience. By utilizing cutting-edge graphic rendering technologies and interactive designs, the virtual simulation system can construct a nearly real martial arts world where students can explore and learn freely. This immersive feeling undoubtedly greatly enhances students' interest and motivation in learning, enabling them to focus more on mastering martial arts skills while enjoying a visual feast. Moreover, virtual simulation technology offers multi-perspective display methods that allow students to observe and understand martial arts movements from different angles and levels. Whether it's the beginning, process, or conclusion of a movement, students can adjust their viewing angle to gain a comprehensive and unobstructed observational experience. This intuitive and vivid learning method not only helps students grasp the essentials and techniques of movements more accurately but also enhances their perception and understanding of martial arts

skills, thereby effectively improving learning efficiency. Additionally, the immersive learning experience provided by virtual simulation technology helps cultivate students' spatial perception and directional judgment abilities, as they need to continually adjust their positions and postures in the virtual environment to adapt to different martial arts movements and scenarios.

4.3 Precise Data Analysis to Optimize Teaching Effectiveness

Another significant advantage of virtual simulation technology in college martial arts teaching is its precise data analysis capability. By real-time recording and analyzing students' learning data and performances, virtual simulation systems can provide teachers with detailed and accurate teaching feedback and assessments. This data not only helps teachers understand students' learning progress and mastery levels but also reveals issues and shortcomings that students may have [3].

An analysis of survey data involving 120 students found that the majority hold high expectations for the application of VR technology in martial arts education. Specifically, 83 students, or 69.17%, expressed anticipation for the integration of VR technology into their martial arts learning, while 21 students (17.5%) were skeptical about it, and only 6 students (5%) did not hold any expectations. Additionally, 10 students (8.33%) were indifferent regarding the technology. This data clearly indicates that most students have a positive outlook on the use of VR technology in martial arts education (as shown in Table 2).

Table 2. Survey on Teachers' and Students' Attitudes Toward the Application of VR Technology in Martial Arts Teaching

Research subjects	expectation	Doubt	No expectation	it doesn't matter	total number
Student	83	21	6	10	120
	69.17%	17.5%	5%	8.33	100%
Teacher	2	—	1	—	3
	66.67%	—	33.33%	—	100%

Furthermore, surveys conducted with 3 martial arts teachers showed that 2 of them were willing to learn VR operation skills, representing 66.67% of the total, while only 1 teacher was resistant to learning, accounting for 33.33%. This data strongly suggests that the majority of teachers are open to learning VR technology, providing a solid foundation for the effective application of VR technology in martial arts classes. Statistical significance analysis further confirms that teachers who are willing to learn VR technology have a significantly high demand ($p < 0.001$) and engagement ($p < 0.001$) regarding VR classes.

These data are important because martial arts teaching not only serves as a medium for conveying sports information but also includes a series of complex behaviors aimed at transmitting information, such as selection, collection, classification, and processing. In this regard, virtual simulation technology, through precise data analy-

sis, can real-time record and analyze students' learning data and performances, offering teachers detailed and accurate teaching feedback and evaluations. This not only aids teachers in accurately grasping students' learning progress and comprehension levels but also effectively reveals the problems and deficiencies that students may have, ultimately optimizing teaching effectiveness.

5 Application Paths of Virtual Simulation Technology in College Martial Arts Teaching

5.1 Utilizing Virtual Simulation Technology for Refined Teaching

In exploring new pathways for martial arts education, virtual simulation technology demonstrates unprecedented potential, providing robust support for achieving refined teaching. This technology deeply extracts and analyzes each student's individual martial arts learning data, laying a solid foundation for customized teaching plans and promoting the development of autonomous training and self-enhancement abilities. In an era of rapid technological advancement, virtual simulation technology not only serves as a cutting-edge tool but also acts as a significant driving force for the modernization of martial arts education.

With this advanced technology, students can fully utilize various virtual devices to engage in foundational training activities, such as neural reflex training, mental adjustment, muscle strength training, and improving action accuracy. During this process, each student can follow meticulously tailored guidance from teachers, allowing them to focus on specific training details based on their learning progress, physical condition, and skill mastery level, ensuring that each step is grounded and each move is practiced accurately^[4]. Notably, the application of virtual simulation technology in detail training paves new paths for skill enhancement by constructing one-on-one virtual interactive training environments, allowing students to conduct intensive practice targeting their weak areas, making detailed training an effective means to address personal shortcomings and elevate overall skills.

Taking the "Horse Stance Punch" movement in martial arts as an example, the application path of virtual simulation technology in college martial arts education reveals significant advantages. In traditional teaching, students often struggle to accurately grasp the stability of the horse stance and the power and speed of the punch. However, virtual simulation technology, through high-precision motion capture and analysis, provides students with a new learning platform. On this platform, students don specialized virtual devices and enter a realistic virtual martial arts training arena. The system customizes a training plan for the Horse Stance Punch based on students' body data and historical training records. During the training, the virtual environment provides real-time feedback on students' motion data, such as the width of the horse stance, the degree of knee bending, and the speed and force of the punch, and compares it with standard movements. If a student's movements deviate, the system not only immediately points out the errors but also visually demonstrates the correct techniques through simulated opponents or mentors. This immediate feedback and correc-

tion mechanism allows students to gradually master the essence of the Horse Stance Punch through continuous attempts and adjustments. With repeated training, students' movements become increasingly standardized, and their power and speed significantly improve. This case fully illustrates the practical application effects of virtual simulation technology in martial arts education, providing strong support for the refinement and personalization of martial arts teaching in colleges.

5.2 Utilizing Virtual Simulation Technology for Remote Teaching

In the expansive exploration of martial arts education, virtual simulation technology is opening up new territories for remote teaching and training with its unique advantages. By simulating real martial arts training environments, this technology constructs highly realistic virtual scenes, enabling students to experience training as if they were physically present [5]. During the learning and practice of martial arts movements, students can refer to virtual digital models that precisely replicate every detail of the martial arts movements and provide standardized demonstrations. This helps students quickly enhance the standardization and accuracy of their movements.

This remote teaching model, closely integrating virtual simulation technology with practical training, allows students to conduct effective practice exercises from home or other locations far removed from traditional classrooms. They can always refer to the virtual data models to make detailed corrections to their movements, ensuring that each practice session achieves the best possible results. In this process, virtual simulation technology acts like an invisible coach, constantly accompanying students and providing immediate guidance and feedback. Moreover, when students participate in remote teaching training in real classroom environments, virtual simulation technology can also play a significant role (as shown in Figure 1). Through this technology, students can access real-time training data and feedback, which greatly enhances their learning experience and transforms remote teaching from a monotonous, interactive-deficient mode into an engaging one. Teachers also play a crucial role in this process; through the remote data monitoring system, they can instantly grasp students' training statuses, promptly detect and correct movement discrepancies, and maximize training effectiveness.

Using the classic movement "Tai Chi Cloud Hands" in martial arts as an example, the application of virtual simulation technology in remote martial arts education showcases its profound and lasting impact. In this innovative teaching model, even from a great distance, students can receive professional guidance similar to face-to-face instruction through virtual simulation platforms. In the virtual environment, students are first led into an ancient-looking Tai Chi training arena surrounded by green mountains and flowing water, immersed in a peaceful and harmonious atmosphere. As soft traditional music plays, a virtual Tai Chi master appears before the students, gradually demonstrating each intricate movement of "Cloud Hands," from gentle arm swings to light foot movements and the perfect harmony of breath and movement. Every detail is precisely captured and presented to the students. Students their view to closely observe the master's movements and even interact with the master in the virtual environment, asking about the key details of the movements and

receiving immediate feedback and guidance. This immersive learning experience greatly stimulates students' interest in learning, allowing them to gradually grasp the essence of "Cloud Hands" in a relaxed and enjoyable atmosphere [6].

Over time, the long-term effects of virtual simulation technology in martial arts education become increasingly apparent. Students achieve a deeper mastery of martial arts skills, with their movements becoming more standardized and fluid. More importantly, their interest in learning martial arts is continuously ignited and maintained; they no longer view martial arts as a tedious training exercise but rather as a pursuit of physical and mental harmony and an appreciation of traditional culture.

Additionally, virtual simulation technology deepens students' understanding of the traditional culture behind martial arts. In the virtual environment, students can learn martial arts techniques while also experiencing cultural elements such as ancient architecture, traditional clothing, and classical music, which reflect the richness of Chinese traditional culture. This comprehensive cultural immersion not only enriches their martial arts learning but also exposes them to the essence of traditional culture, fostering a greater appreciation for and desire to preserve this invaluable cultural heritage.

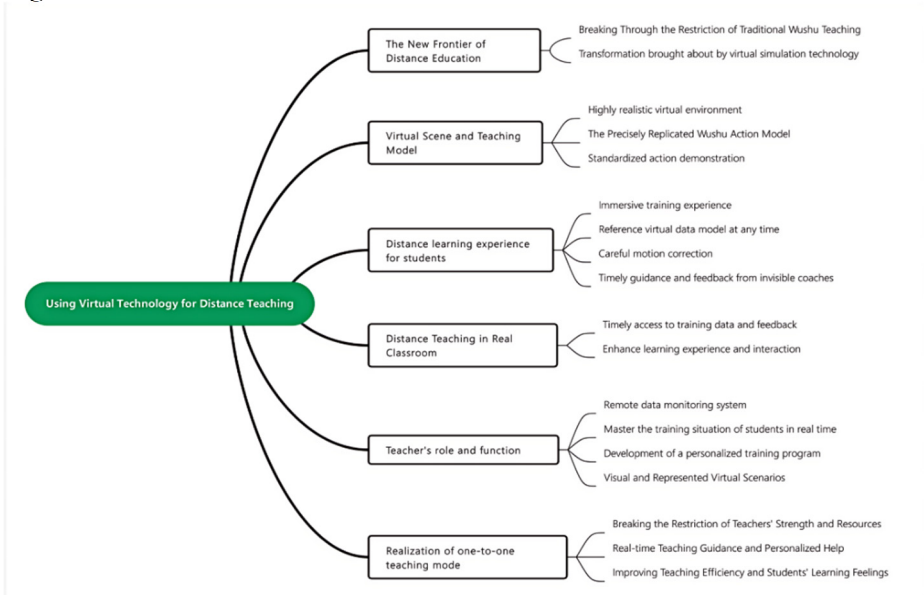


Fig. 1. Advantages and approaches of virtual simulation technology in distance education

5.3 Implementing Open Teaching through Virtual Simulation Technology

Open teaching, as an extension and innovation of remote teaching, is gradually emerging as a new force in the field of martial arts education. It skillfully integrates virtual simulation technology, remote interaction capabilities, vast online learning resources, and personalized learning pathways to construct a modern and flexible learning ecosystem. In this platform, martial arts learning is no longer restricted by

geographic location; students can engage in precise technical training in a virtually constructed environment while interacting and competing in real-time with peers from afar, significantly broadening the boundaries of learning.

The core of open teaching in martial arts lies in its openness and inclusivity. By providing a wealth of diverse learning resources—such as video tutorials, movement decomposition charts, and virtual combat simulations—students can freely choose the content and modes of learning based on their progress and interests. Additionally, the establishment of community exchange platforms promotes interaction and sharing among students, transforming learning from an isolated endeavor into a collective gathering and clash of wisdom.

The introduction of personalized training plans and intelligent feedback mechanisms is a major highlight of open martial arts teaching. The system can intelligently recommend suitable training content based on students' skill levels, learning styles, and progress, providing real-time feedback and guidance during training to ensure that each student receives a tailored learning experience. This personalized teaching approach not only enhances learning efficiency but also significantly boosts students' motivation and satisfaction.

In the practice of open teaching in martial arts, teachers should be bold enough to break free from traditional concepts and actively explore and innovate teaching models. From the outset of instructional design, they should consider students' actual needs and interests, scientifically planning teaching activities to tightly integrate theoretical knowledge with practical skills. For instance, when teaching basic martial arts movements, teachers can use virtual simulation technology to allow students to experience and familiarize themselves with movement essentials through simulated activities before formal learning, thus igniting their interest and enthusiasm for learning. Furthermore, the open teaching model encourages teachers to allocate time for autonomous exploration, allowing students to select practice content and difficulty based on their personal interests and needs. Combined with the assistance of virtual simulation technology, students can safely challenge themselves with varying levels of training, continually pushing their limits and improving their skill mastery and adaptability. This student-centered teaching approach not only cultivates students' autonomous learning abilities but also fosters their overall development and growth.

5.4 Implementing Competition Teaching through Virtual Simulation Technology

In the current practice of martial arts education in higher education, the scarcity of competitive opportunities and the limitations of time and space often hinder students' skill enhancement and accumulation of practical experience. To overcome these challenges, competition teaching has emerged, aiming to allow students to quickly improve their capabilities through simulated, standardized competitive processes in an environment closely resembling real competitions, achieving the goal of learning through competition. Competition teaching is divided into two phases: basic competition and advanced competition, each carrying different teaching tasks and objectives. The basic competition phase focuses on stimulating students' interest through rich teaching con-

tent and foundational skills training, promoting their overall development. This phase primarily relies on competitive data models from martial arts professionals, which include detailed data on athletes' techniques, skill applications, strategic layouts, and personal styles, serving as strong demonstrations. During training exercises against these models, students can deeply understand the essence of martial arts competitions and simulate professional athletes' competitive processes, thereby gaining more insights into competition and broadening their competitive horizons. In the basic competition, teachers play the role of facilitators, guiding students to conduct basic competitions more efficiently through autonomous demonstration processes and helping them quickly grasp the fundamental points of competition. As a comprehensive teaching process, basic competitions possess strong diversity, providing timely feedback and guidance, making the entire teaching system more engaging.

The advanced competition phase, on the other hand, emphasizes the depth and breadth of engagement. This phase requires students to tackle more complex challenges, cultivating their analytical, innovative, and problem-solving abilities. In addition to conducting remote simulations and open simulations, students must complete a series of processes, such as foundational training, pre-competition training, warm-up preparations, on-site coaching, and competition reviews, all in accordance with martial arts competition standards. Through these comprehensive training and guidance efforts, students can achieve substantial improvements in their technical skills while also enhancing their psychological resilience, tactical applications, and competition strategies.

6 Long-term Effects of Virtual Simulation Technology in Martial Arts Education

The long-term effects of virtual simulation technology in martial arts education are significant and profound. In terms of skill mastery, this technology provides students with a highly precise and repeatable training environment. Through virtual simulation, students can repeatedly practice martial arts movements until they meet standards, while the system can capture and analyze students' movements in real-time, providing immediate feedback and guidance to help students quickly correct mistakes and continually improve the accuracy and fluidity of their movements. This fine-tuned training approach greatly enhances students' learning efficiency, enabling them to master challenging martial arts skills in a relatively short time.

Secondly, virtual simulation technology effectively stimulates students' sustained interest in martial arts. Traditional martial arts teaching often relies on verbal explanations and demonstrations by teachers, which can struggle to fully showcase the charm and depth of martial arts. In contrast, virtual simulation technology offers realistic scene simulations and interactive experiences, allowing students to feel as if they are in a real martial arts world. They can spar with virtual characters, experiencing the intensity and excitement of martial arts combat, and practice in different virtual environments to experience various styles of martial arts. This immersive learning method

not only satisfies students' curiosity and desire for exploration but also enhances their passion and pursuit of martial arts as they enjoy the learning process.

Furthermore, virtual simulation technology deepens students' understanding of traditional culture. As an important component of Chinese traditional culture, martial arts carries rich historical and cultural connotations. Through virtual simulation technology, students can engage with related traditional cultural elements, such as ancient philosophical thoughts, traditional medical theories, and folktales, while learning martial arts. These elements not only enrich students' learning experiences but also help them better understand the essence and value of martial arts, cultivating a profound respect and emotional connection to traditional culture. Over time, this understanding and recognition of traditional culture will assist students in forming accurate values and worldviews, ultimately becoming culturally literate and nationally proud youths in the new era.

7 Conclusion

In summary, the application of virtual simulation technology in college martial arts teaching holds broad prospects and tremendous potential. Through a comprehensive analysis of its current application status, the challenges it faces, its advantages, and specific application pathways, it is apparent that virtual simulation technology can bring new opportunities and challenges to college martial arts education. In future development, we should fully leverage the advantages of virtual simulation technology, continuously innovate teaching methods and approaches, and enhance teaching effectiveness and quality. Additionally, attention should also be given to potential issues and shortcomings of virtual simulation technology in college martial arts education, with active exploration of solutions and measures. It is believed that, in the near future, virtual simulation technology will become an important component of college martial arts teaching, contributing to the modernization and efficiency of martial arts education.

References

1. Meng Yunpeng, Wang Yukun. Research on the application path of virtual simulation technology in martial arts teaching in colleges and universities [J]. *Journal of Jilin College of Physical Education*, 2024, 40 (03): 72-77+84.
2. Wang Jianjun. The application of virtual simulation technology in the teaching of college physical education majors [J]. *Contemporary Sports Technology*, 2024, 14 (14): 58-61. DOI:10.16655/j.cnki.2095-2813.2024.14.016.
3. Yang Wenyi, Tian Chunlan. Research on the importance and countermeasures of assisted teaching in sports majors in colleges and universities with the help of virtual simulation technology [J]. *Sports Science and Technology Literature Bulletin*, 2022, 30 (01): 127-130. DOI: 10.19379/j.cnki.issn.1005-0256.2022.01.037.
4. Shao Ruifang. Applied research on virtual simulation technology in classroom teaching of physical education professional courses [D]. Hangzhou Normal University, 2018./

5. You, J.A. Why Physical Education Teacher as Curriculum Maker? *Korean J. Sport Pedagog.* 2010, 17, 1–18.
6. Darling-Hammond, L. Teacher Education and the American Future. *J. Teach. Educ.* 2009, 61, 35–47.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

