

Professional Development of Rural PE Teachers from the Perspective of PCK: A Case Study of Huaiji County

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Abstract Based on the four dimensions of PCK, this paper investigates the professional development of rural PE teachers in Huaiji County by using the research methods of literature, questionnaire, interview and mathematical statistics. Based on PCK related theories, this paper analyzes the current situation of professional development of rural PE teachers in Huaiji County, explores the problems existing in the process of professional development, and provides an optimal path for the professional development of rural PE teachers, so as to improve the teaching ability and classroom quality of rural PE teachers, and promote the further development of rural PE education under the background of new curriculum reform. Through the research, it is found that the shortcomings of rural PE teachers are: lack of situational knowledge; lack of understanding of the course content; not flexible use of teaching representation; low ability to identify the differences of students' learning styles; lack of understanding of social environment, *etc.*

Key words PCK; Rural PE teacher; Professional development

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With the proposal of the "sports power" strategy in recent years, the physical fitness of students has also been increasingly valued by the state and education departments. Government departments have issued policy documents such as the *Opinions on Deepening the Integration of Sports and Education to Promote the Healthy Development of Youth* and the *Opinions on Strengthening and Improving School Sports Work in the New Era*. It emphasizes that as an important part of school education, school sports bear the significant responsibility of enhancing physical fitness of students, and promoting the physical and mental health of students. Especially for PE teachers who play a leading role in physical education courses, their professional development is the basic guarantee for improving the quality of physical education teaching and strengthening the level of school education.

In 2018, the State Council issued the *Opinions on Comprehensively Deepening the Reform of Teacher Team Construction in the New Era*, proposing to comprehensively improve the quality of rural primary and secondary school teachers, promote the quality and intensity of rural teacher training, and provide policy tilt and support for the professional development of rural teachers. However, there is still a widening gap in the development of rural and urban teachers in China, especially rural PE teachers. Due to external factors such as low recognition and importance of physical education in school disciplines, and uneven allocation of educational resources between urban and rural areas, the cultural

capital required for the professional development of rural PE teachers cannot be guaranteed. At the same time, rural PE teachers themselves have weak awareness of actively improving their professional level and insufficient internal drive for professional development^[1]. As far as current research is concerned, most studies on rural PE teachers focus on the macro level of teacher professionalization, such as the allocation, continuing education and training, career planning and education of PE teachers, and less focus on the professionalization degree of individual teacher development.

Dr. Shulman, a renowned American educator, was the first to propose the theory of Pedagogical Content Knowledge (PCK), which refers to subject teaching knowledge. It refers to a set of unique teaching knowledge and style formed by teachers through practice and continuous accumulation. It emphasizes that teachers organize and present knowledge of specific topics, problems or topics to learners, to adapt to learners with different interests and abilities^[2]. PCK is the core of teacher professional development and an important breakthrough in the professional growth of PE teachers. It includes PE teachers' mastery of subject content knowledge, students' understanding, *etc.* Therefore, the professional development of rural PE teachers should emphasize the development of PCK, which is also an important evaluation indicator for the professional development of rural PE teachers^[3]. It is a new extension of the professional growth path for rural PE teachers by integrating the concept of PCK into the research on the professional development of rural PE teachers, and exploring the influencing factors and internal mechanisms of PCK growth for rural PE teachers, thereby deepening the theoretical system of professional development for rural PE teachers^[4].

Based on the perspective of PCK, this study investigates the professional development situation of rural PE teachers in Huaiji

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County, identifies the shortcomings in the current development system, and analyzes the new requirements for the development of rural PE teachers in the new era^[5]. It also explores strategies for PE teachers in rural primary and secondary schools to strengthen subject teaching knowledge base, effectively improving the teaching ability of rural PE teachers and PCK. It improves the quality of rural physical education, provides guarantees for the physical and mental health and comprehensive development of rural students, further narrows the urban-rural education gap, and achieves educational equity.

1 Research objects and methods

The current situation of professional development of rural PE teachers in Huaiji County of Zhaoqing is taken as the research object. By searching professional websites such as CNKI and Wanfang, collecting relevant policy documents released by the government, organizing and analyzing literature and materials related to this study, understanding of rural PE teachers, PCK, and other contents is deepened, providing a theoretical basis.

In terms of questionnaire content and structure design, sufficient preparation is made for the questionnaire design by consulting relevant literature and materials related to this paper. This paper mainly draws on the concept of PCK in the research of Cochra *et al.*, which refers to the teacher's understanding of general teaching methods, subject content, student characteristics and learning situations, as well as the theoretical framework of PCK comprehensive understanding. It constructs measurement indicators and frameworks for the professional development of rural PE teachers in the questionnaire from four dimensions: content knowledge, teaching knowledge, student knowledge, and situational knowledge^[6]. Using the questionnaire survey method, the questionnaires are distributed to PE teachers below the county level in Huaiji County, to explore the development of PCK among rural PE teachers in Huaiji County, and conduct relevant surveys on their teaching progress and the current situation of rural teaching envi-

ronment. At the same time, some rural PE teachers in Huaiji County are selected for interviews to understand their understanding and application of PCK, as well as their views on teaching ability and satisfaction with the current teaching situation.

2 Results and analysis

2.1 PCK score results and analysis for rural PE teachers

The concept of PCK is interpreted. Based on mastering the four dimensions of content knowledge, teaching knowledge, student knowledge, and situational knowledge, the teacher's PCK is transformed, integrated, and applied to practical teaching^[7]. So the level of knowledge mastery in these four dimensions is particularly important for the professional development of rural PE teachers.

As shown in Table 1, the score settings for the four dimensions of content knowledge, teaching knowledge, student knowledge, and situational knowledge in the PCK of rural PE teachers in Huaiji County are 30, 25, 25, and 25 points, respectively, with mean scores of 25.15, 20.82, 12.56, and 12.41, accounting for 83.82%, 83.26%, 83.75%, and 82.72% of the total score. The score proportions of PE teachers in terms of teaching content knowledge, teaching knowledge, and student knowledge are all higher than 83%, while the score of situational knowledge is relatively low, only 82.72%, indicating that PE teachers have slightly insufficient knowledge mastery in this area. The difference between the maximum and minimum scores of each dimension is significant. For example, in the aspect of content knowledge, the highest score is 30 points, but the lowest score is only 17 points, indicating that there are significant differences in the individual professional development of rural PE teachers in Huaiji County. The analysis on the mean score and the proportion of scores in each dimension cannot fully understand the PCK knowledge mastery of rural PE teachers. Therefore, specific analysis will be conducted on each dimension in the future^[8].

Table 1 Statistics of various dimensions of PCK for rural PE teachers

Dimension	Score proportion//%	Mean	Standard deviation	Maximum value	Minimum value	points
Content knowledge	83.82	25.15	2.92	30	17	
Teaching knowledge	83.26	20.82	2.56	25	13	
Student knowledge	83.75	12.56	1.49	15	9	
Situational knowledge	82.72	12.41	1.57	15	8	

2.2 Score results and analysis of content knowledge in PCK for rural PE teachers

PCK of PE teacher is the process by which teachers process, transform, and apply the knowledge and skills of the physical education subject to actual teaching. The grasp of subject content by PE teachers has a direct impact on their selection of content and methods in teaching practice activities, which in turn affects the quality and effectiveness of physical education teaching^[9]. Therefore, mastering the content knowledge of physical education is the most fundamental and core element in the professional development of teachers. The content knowledge of PE

teachers is mainly divided into six aspects: sports ethics and safety knowledge; practical tactical knowledge; ability to recognize frequently incorrect actions; reasonable arrangement of teaching content; clearness of teaching objectives; deep understanding of course content. The total score for PCK content knowledge is 30 points, with 5 points for each of the six aspects mentioned above. As shown in Table 2, after mathematical statistics, the average scores of rural PE teachers in Huaiji County in six aspects of content knowledge are 4.25, 4.19, 4.16, 4.20, and 4.12, with scores accounting for 85.05%, 83.88%, 83.88%, 83.11%,

84.08% , and 82.33% , respectively. The highest scoring item is the ability to apply sports ethics and safety knowledge , with a score of 4.25. The lowest scoring item is the ability to deeply understand the course content , with a score of 4.12. The most direct reason for insufficient understanding is the teacher’s lack of theoretical knowledge in the field of physical education. In addition, in the area of sports ethics and safety knowledge, some teachers only

scored 1 point, indicating that teachers urgently need to strengthen in this aspect. In the three aspects of identifying frequently incorrect actions, clarifying teaching objectives, and deeply understanding course content, there is also a situation where the score is only 2 points. Some PE teachers need to strengthen the teaching foundation of physical education.

Table 2 Statistics of content knowledge scores in PCK of rural PE teachers points

Item	Score proportion//%	Mean	Standard deviation	Maximum value	Minimum value
Sports ethics and safety knowledge	85.05	4.25	0.65	5	1
Practical tactical knowledge	83.88	4.19	0.53	5	3
Ability to recognize frequently incorrect actions	83.88	4.19	0.60	5	2
Reasonable arrangement of teaching content	83.11	4.16	0.64	5	3
Clearness of teaching objectives	84.08	4.20	0.58	5	2
Deep understanding of course content	82.33	4.12	0.60	5	2

2.3 Score results and analysis of teaching knowledge in PCK of rural PE teachers Teaching knowledge refers to the means and strategies used by PE teachers to transform content knowledge of physical education subject into teaching practice activities. It is the key to whether students can effectively grasp and understand knowledge and spirit of physical education subject^[3]. Therefore, it is also an important part of the professional development of PE teachers by mastering and applying teaching knowledge. The teaching knowledge in PCK of PE teachers mainly includes correct explanations, commands, and demonstrations; clarifying the teaching and learning methods; after-school teaching reflection and

feedback; timely teaching feedback; organizing classroom formation queue. In the questionnaire design, the total score of PCK teaching knowledge is 25 points, with the highest score of 5 points for each item. According to the statistics of the questionnaire, the average score of rural PE teachers is the lowest in correct explanation, password, and demonstration, with a score of 4.13 points, accounting for 82.52% of the total score. The highest is organizing classroom formation queue, with a score of 4.19 points (Table 3). Overall, there are relatively small differences in various aspects, but some PE teachers have shortcomings in teaching methods, timely teaching feedback, and organizing classroom order.

Table 3 Statistics of teaching knowledge scores in PCK of rural PE teachers points

Item	Score proportion//%	Mean	Standard deviation	Maximum value	Minimum value
Correct explanations, commands, and demonstrations	82.52	4.13	0.57	5	3
Clarifying the teaching and learning methods	83.50	4.17	0.58	5	2
After-school teaching reflection and feedback	83.30	4.17	0.56	5	3
Timely teaching feedback	83.30	4.17	0.61	5	2
Organizing classroom formation queue	83.88	4.19	0.56	5	2

2.4 Score results and analysis of student knowledge in PCK of rural PE teachers The student knowledge in PCK of PE teachers refers to the teacher’s cognitive level of the student’s learning foundation, physical and mental characteristics, *etc.* It is a conditional knowledge that the teacher transforms subject content knowledge^[3]. In the physical education curriculum standards, emphasis is placed on student-centered and personalized teaching activities for students. Therefore, teachers need to understand and recognize the characteristics of students, which is also the key to their professional development. The teaching knowledge of PE teachers in PCK is divided into three parts: identifying develop-

mental characteristics of students, identifying individual differences of students, and identifying physical and mental qualities of students. The total score of teaching knowledge is 15 points, with a maximum score of 5 points for each item. As shown in Table 4, the lowest average score for rural PE teachers is 4.16 points (identifying individual differences of students) , accounting for 83.11% of the total score, while the highest is 4.21 points (identifying physical and mental qualities of students). The difference between the maximum and minimum scores of each item is relatively small. Overall, rural PE teachers in Huaiji County have a relatively good level of professional development in terms of student knowledge.

Table 4 Statistics of student knowledge scores in PCK of rural PE teachers points

Item	Score proportion//%	Mean	Standard deviation	Maximum value	Minimum value
Identifying developmental characteristics of students	83.88	4.19	0.53	5	3
Identifying individual differences of students	83.11	4.16	0.57	5	3
Identifying physical and mental qualities of students	84.27	4.21	0.50	5	3

2.5 Score results and analysis of situational knowledge in PCK of rural PE teachers The context of physical education

teaching refers to the sum of external environments that have a direct impact on physical education teaching activities and have a

significant impact on the effectiveness of physical education teaching^[10]. Situational knowledge is the pathway condition that knowledge transformation in physical education teaching must be based on^[11]. It is the entire context, background, and environment related to participating in physical education teaching, and is a social system that is interconnected and interdependent in the overall environment of social activities. Therefore, based on the needs of meeting the physical and mental development of students and improving teaching efficiency, PE teachers should master the knowledge of the physical education teaching environment, and create and improve an external environment suitable for teaching on this

basis. Situational knowledge in PCK includes understanding of three parts: school context, class context, and social context. The total score of PCK situational knowledge is 15 points, with each part scoring 5 points. Seen from Table 5, the lowest average score for rural PE teachers is their understanding of the social environment, which is 3.86 points, accounting for 77.28% of the total score. The highest score is their understanding of the school environment, which is 4.36 points. Among them, all teachers have a high level of proficiency in terms of understanding the school environment, while some rural PE teachers have insufficient understanding of social situations, only receiving 1 point.

Table 5 Statistics of situational knowledge scores in PCK of rural PE teachers

Item	Score proportion//%	Mean	Standard deviation	Maximum value	Minimum value
Understanding school context	87.18	4.36	0.48	5	4
Understanding class context	84.85	4.24	0.51	5	3
Understanding social context	77.28	3.86	0.83	5	1

points

3 Conclusions

3.1 Significant differences in the professional development of individual teacher Some teachers have a higher level of mastery in the four dimensions of content knowledge, teaching knowledge, student knowledge, and situational knowledge in PCK, but there are also some teachers who score lower in these four dimensions. According to a survey, education level of rural PE teachers are mostly concentrated in vocational college or above in the Huaiji area, and there is no PE teacher with a master's degree. Therefore, there are significant differences in the professional development level of rural PE teachers in Huaiji County, with varying levels of teaching staff. Different teachers need to be improved and strengthened for their lack of knowledge in various aspects, to promote their own professional development.

3.2 Some rural PE teachers lacking mastery of subject content knowledge The subject content knowledge that PE teachers need to master includes their understanding of the curriculum content, which can be summarized into three parts: physical fitness, skills, and health education^[3]. In the field of content knowledge, the understanding of course content is the one with the lowest average score among the six items. Subject content knowledge is the most core knowledge in the professional development of teachers and the foundation for carrying out physical education teaching activities. Additionally, some teachers lack the mastery and application of sports ethics and safety knowledge. In the context of the new curriculum reform and new curriculum standards, emphasis is placed on "cultivating students with moral character" and cultivating students to achieve core competencies in sports. Therefore, sports ethics and safety knowledge are the parts that rural PE teachers in Huaiji County urgently need to strengthen.

3.3 Some rural PE teachers lacking flexibility in using teaching representations Among the five indicators of teaching knowledge, the average score for correct explanation, password, and demonstration is only 4.13 points, which is the lowest among the five indicators. At the same time, some PE teachers have lower scores in teaching methods, teaching comments, queue organiza-

tion, and other aspects, with shortcomings. The part of teaching knowledge reflects the application of teaching representation by PE teachers. Teaching representation is the most intuitive way for teachers to express themselves in teaching. Through oral explanation, correct action demonstrations, and the use of commands, PE teachers enable students to quickly and effectively grasp the content and skills of physical education courses. There are significant differences in the cognitive level and learning ability between teachers and students, so teachers are unable to directly transmit their mastery of sports knowledge and action skills to students. Instead, they need to find appropriate and effective ways of transmission, namely teaching strategies and teaching representations. The quality of a physical education class often depends on the use of teaching representations^[12].

3.4 Some rural PE teachers insufficiently understanding the characteristics and differences of students In the field of student knowledge, the average score for identifying differences in student learning styles is the lowest, at 4.16 points. The lack of understanding of students and observation of details in physical education teaching is the most direct cause of low recognition ability. Students are developing individuals, and they are unique individuals. It can effectively implement personalized teaching by correctly identifying learning styles of students. Each student has their own unique style, and education cannot be one size fits all, let alone applied in one way to all students^[13]. In the professional development of PE teachers, it is necessary to have the ability to teach according to individual needs, which could stimulate students' autonomy, reflect their subjectivity, and achieve differentiated and personalized teaching methods.

3.5 Some rural PE teachers lacking situational knowledge The lowest score among the four dimensions of PCK for PE teachers is situational knowledge, which often includes the school environment, class environment, and social environment. The low score of situational knowledge may be due to the fact that the school is mostly located in mountainous areas, which reduces the opportunities for PE teachers to access new knowledge and accumulate less

situational knowledge materials. Rural PE teachers have lower ability to create situational classrooms. Among them, many rural PE teachers urgently need to enhance their understanding of the social context, which mainly includes social education scenes and social education environments^[14]. The lack of corresponding social practice experience among teachers in physical education teaching is the main reason for the low score in this area, and the insufficient utilization of social resources by schools is also an important factor. For rural PE teachers, it is a more important part by understanding the social context. Compared to cities, the social environment in rural areas may be relatively complex, such as low emphasis on physical education and insufficient teaching facilities.

4 Suggestions

4.1 Providing external support for the professional development of rural PE teachers Firstly, it is necessary to establish a social support system that adapts to the professional development of rural PE teachers. The relevant education departments should grasp the strategy of "sports power", increase financial investment in rural sports education, and improve the quality of rural social space. Based on the main demands of rural PE teachers, teacher treatment, the supply of teaching resources and facilities should be improved. At the same time, it should improve the incentive, evaluation, and promotion mechanisms for rural PE teachers, providing institutional guarantees for the professional development of rural PE teachers^[15]. Secondly, by aligning with the "rural revitalization" strategy, it could bring a sense of mission and responsibility to rural PE teachers. By fully utilizing their unique sports skills and health knowledge, it could play their key role in promoting rural fitness and developing rural sports tourism. It could drive rural residents to carry out daily exercise and health management, and provide guidance to enrich their sports and cultural life, so as to enhance the sense of professional achievement of rural PE teachers and promote their professional development to meet social needs.

In addition, schools should provide training platforms and development space for rural PE teachers. By conducting specialized training, lesson exchange meetings, teaching evaluations, and other activities, it could create a positive learning atmosphere for teachers, expand the horizons of rural PE teachers, promote their understanding and comprehension of various dimensions of knowledge, and encourage and promote their professional development.

4.2 Rural PE teachers achieving self-development from the perspective of PCK

4.2.1 Strengthening the understanding and mastery of subject knowledge. The subject content knowledge of rural PE teachers is mainly based on the knowledge learned during their student years. In their career, they still need to continuously consolidate and update their professional knowledge and skills in the field of physical education. PE teachers need to conduct in-depth research on physical education textbooks, which are important theoretical resources for carrying out physical education teaching practice. At the same time, by actively participating in knowledge and skills training, fully utilizing educational information resources, and other means,

they can consolidate physical education content knowledge which the most basic part in PCK, in order to promote the formation of their own PCK and professional development.

4.2.2 Paying attention to students' performance in physical education practice of school. In physical education curriculum of school, student development is the core element. Rural PE teachers can better carry out physical education teaching and achieve the goals of physical education teaching only by putting students at the center and understanding them. In teaching, teachers should actively communicate and exchange ideas with students, especially when facing rural students. They should not only pay attention to the differences in physical fitness, sports skills, and other aspects of students, but also think about the psychological development history of students in different families and social backgrounds from the perspective of educational psychology. They should adhere to student-centered and personalized physical education teaching.

4.2.3 Deepening the development of physical education teaching knowledge and situational knowledge. By participating in teaching and research meetings, exchange meetings, and observing public classes and famous teacher classrooms, it could observe the grasp of situational knowledge by excellent PE teachers, and learn the form and application of teaching strategies of excellent PE teachers. Meanwhile, by constantly reflecting on their own teaching activities, and summarizing actual teaching experiences, their teaching knowledge and the ability of understanding teaching situations could be continuously enriched. More importantly, it should apply the methods and theories learned to physical education teaching practice, and continuously adjust and improve them in combination with the context, to achieve professional development.

4.2.4 Realizing the development of PCK towards comprehension and integration. PCK is highly dependent on individual teachers and is the result of multidimensional integration of content knowledge, teaching knowledge, student knowledge, situational knowledge, and other aspects that teachers possess. Teachers need to not only continuously improve the basic knowledge of the four dimensions in PCK, but also have the ability to "be student-centered, combine with practical situations, achieve knowledge transformation, and achieve teaching objectives". In the process of improving and strengthening the PCK of rural PE teachers, the most important thing is the "integration" and "transformation" abilities of teachers. Firstly, rural PE teachers need to conduct in-depth analysis of physical education curriculum standards, subject knowledge, *etc.*, in order to establish a solid foundation for integration. Secondly, the integration and transformation by rural PE teachers should always be based on the needs of rural students, and be carried out in real-life situations such as classes, schools, and society, in order to achieve the best results in physical education teaching. Finally, it is important to focus on the transformation of theoretical knowledge into concrete practice, root in the actual teaching of physical education, and develop a suitable, effective, and personalized teaching method.

4.2.5 Combining rural characteristics to carry out teaching activities. Rural areas have their own unique geographical environment and cultural characteristics. Rural PE teachers should establish in-

and attenuate the current at the lightning point, achieving effective lightning interception^[17]. It will greatly improve the lightning safety of wind farms by installing lightning pulse high-energy absorbers on the power lines of wind turbine power generation systems.

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novative thinking, and strengthen their understanding of social situations. Combining with local characteristics, distinctive teaching resources should be developed, and sports teaching models suitable for rural areas should be created. Combine with local customs and traditional sports culture, school-based courses could be developed. In practice, they should continuously accumulate situational materials and adapt to teaching in different situations. Through various means, their own professional development could be achieved. Utilizing their own knowledge and skills, it could revitalize the sports industry of rural mass, and promote the construction of rural spiritual civilization.

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