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PAPER

Evaluating the Effectiveness of Mobile Interactive Technology in University Physical Education Courses

Man Peng(✉)

Shijiazhuang College of Applied Technology, Shijiazhuang, China

2004110441@sjzpt.edu.cn

ABSTRACT

With the rapid development of mobile interactive technology, a transformative shift in the pedagogical model of university sports courses has been initiated. Traditional teaching methods are simplistic and characterized by their lack of interactivity and personalization. However, the implementation of mobile interactive technology provides students with increased opportunities for participation and access to learning resources. Although existing research focuses on the integration of mobile interactive technology in university sports courses, a significant limitation remains in the evaluation methodologies employed, with a lack of systematic quantitative analysis and a comprehensive evaluation framework. This study proposes an effectiveness evaluation model comprising three primary components: construction of the evaluation model, calculation of indicator weights, and application of the fuzzy comprehensive evaluation method. The objective is to provide a comprehensive understanding of the effectiveness of mobile interactive technology in university sports courses through scientific evaluation methods, offering insights for future educational reforms and technological implementations.

KEYWORDS

mobile interactive technology, university sports courses, effectiveness evaluation, fuzzy comprehensive evaluation method, quantitative analysis

1 INTRODUCTION

As mobile interactive technology rapidly evolves, innovative changes in the teaching models of university sports courses have been observed [1, 2]. Traditional teaching modes in sports courses, predominantly reliant on instructor lectures and student imitation, are direct yet lack interaction and personalization [3–5]. The introduction of mobile interactive technology brings novel pedagogical tools and environments to university sports courses. Through mobile devices and applications, students engage in interaction, participation, and feedback both inside and outside the classroom, enhancing their interest and effectiveness in learning.

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Hence, examining the effectiveness of mobile interactive technology in university sports courses holds significant practical relevance.

Evaluating the effectiveness of mobile interactive technology in university sports courses not only provides a scientific basis for the design and implementation of these courses but also offers insights for its application in other educational fields [6, 7]. Assessing the effectiveness of this technology helps educators better understand its role in enhancing student learning and teaching quality, thereby further advancing educational information technology [8–10]. Additionally, through scientific evaluation, challenges and deficiencies in the application process can be identified and resolved, optimizing teaching strategies and methods.

At present, research on the application of mobile interactive technology in university sports courses has accumulated to some extent. However, the majority of these studies are limited in their evaluation methods. On one hand, many studies remain at the qualitative analysis stage, lacking systematic quantitative evaluations [11–15]. On the other hand, even among studies that have conducted quantitative evaluations, the indicator systems used are often not comprehensive, failing to fully consider the interrelationships among various factors [16, 17]. Moreover, the existing evaluation methods are relatively simplistic and lack a comprehensive framework, which impacts the reliability and scientific validity of the results.

This study aims to systematically assess the effectiveness of mobile interactive technology in university sports courses by constructing a scientific evaluation model. This study includes three parts: first, the construction of an effectiveness evaluation model and establishment of an indicator system; second, the calculation of weights for each indicator to ensure the objectivity and scientific rigor of the evaluation; and finally, the application of the fuzzy comprehensive evaluation method to determine the effectiveness level, providing a comprehensive evaluation result. This study not only addresses the gaps in current research methodologies but also offers new perspectives and methods for the reform and development of university sports courses, significantly contributing to the enhancement of teaching quality in university sports.

2 CONSTRUCTION OF THE EFFECTIVENESS EVALUATION MODEL

To scientifically and systematically assess the effectiveness of mobile interactive technology in university sports courses, a three-tiered evaluation indicator system was established in this study, comprising eight primary indicators and 28 secondary indicators. The specific evaluation system is outlined as follows:

At the primary indicator level, eight key aspects were primarily considered in this study: teaching effectiveness, student participation, technology usage, teaching interaction, learning motivation, teaching resources, teaching evaluation, and overall satisfaction. These primary indicators encompass all critical dimensions of the application of mobile interactive technology in university sports courses. Teaching effectiveness is assessed by examining students' knowledge acquisition, skill enhancement, and learning efficiency. Student participation focuses on classroom attendance rates, post-class interaction frequency, and the enthusiasm of student feedback. Technology usage evaluates the frequency of mobile device use, the convenience of software operations, and the effectiveness of technical support. Teaching interaction is scrutinized by observing the frequency of interaction between teachers and students, among students themselves, and the richness of the interaction content. Learning motivation assesses students' interest in learning, self-directed learning capabilities, and the clarity of learning objectives. Teaching resources focus on the diversity of resources, the frequency of updates, and the applicability of these resources. Teaching evaluation examines the scientific nature of the evaluation system, the fairness of evaluation outcomes, and the timeliness of feedback. Overall satisfaction includes the satisfaction levels of students, teachers, and management staff. Figure 1 displays the structure of the effectiveness evaluation model.

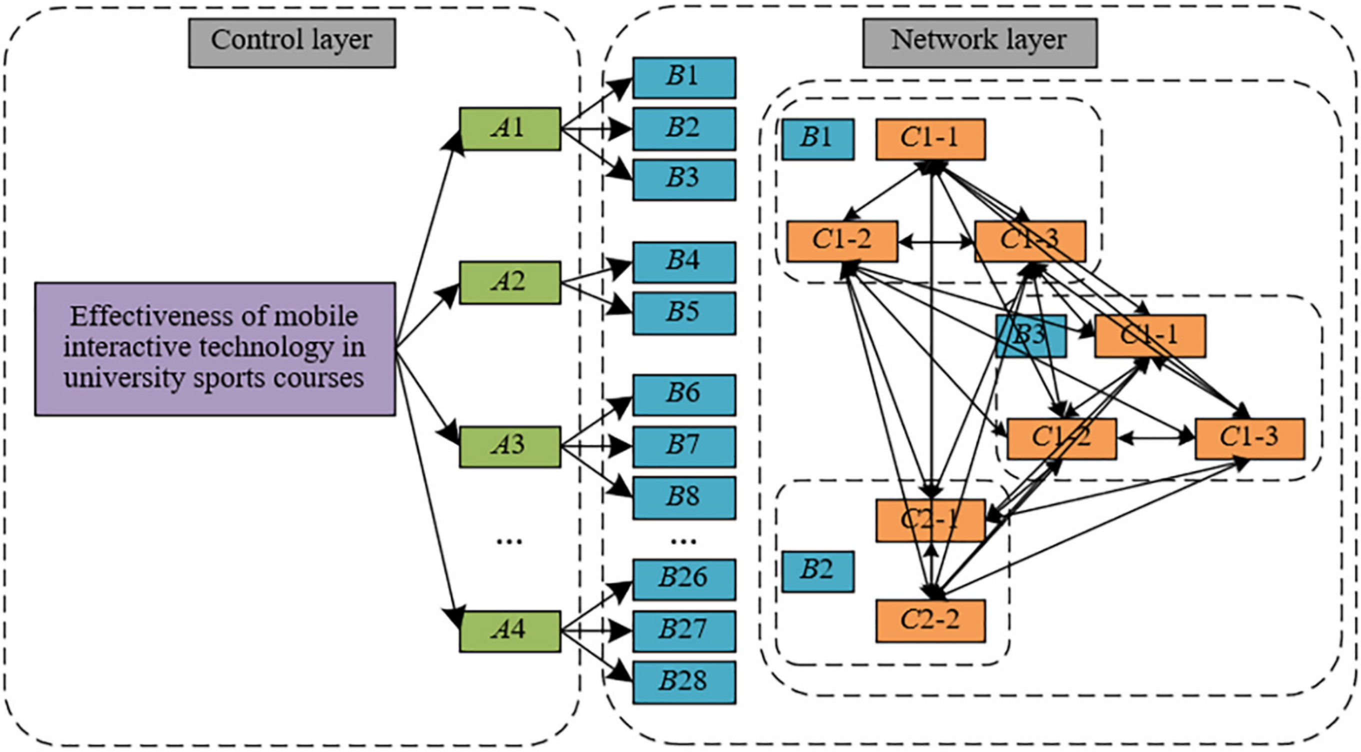

Fig. 1. Structure of the effectiveness evaluation model

3 CALCULATION OF INDICATOR WEIGHTS

Following the construction of the effectiveness evaluation model for the application of mobile interactive technology in university sports courses, the determination of the weights for each indicator is required. The analytic hierarchy process (AHP) was employed to calculate the weights of the primary indicators. AHP is a method that combines subjective and objective weighting approaches, aimed at determining the relative importance of each indicator through the expertise and professional knowledge of experts.

Secondary and tertiary indicators, positioned at the network layer, utilize the network analysis process (ANP) for weight calculation. ANP, a complex multi-criteria decision-making method, permits interdependencies and feedback among indicators. The weighted super matrix was derived from the initial super matrix by introducing the weights of the primary indicators and adjusting the weights of the secondary and tertiary indicators accordingly. Initially, the weights of the primary indicators were distributed to the secondary indicators and further allocated to the tertiary indicators. This step involves adjusting the initial super matrix to ensure that the weighted super matrix accurately reflects the weight relationships among the indicators. Since Q is not a column-normalized matrix, to obtain the weighted super matrix, it is necessary first to compare the importance of the secondary indicators $Y_u\{u = 1, 2, 3, ..., v)$ with $Y_m\{m = 1, 2, 3, ..., v)$ as the sub-criteria. The weighted matrix of the secondary indicators, Y, is represented by the following equation:

$$Y = \begin{bmatrix} y_{1-1} & y_{1-2} & \cdots & y_{1-v} \\ y_{2-1} & y_{2-2} & \cdots & y_{2-v} \\ \vdots & \vdots & \ddots & \vdots \\ y_{v-1} & y_{v-2} & \cdots & y_{v-v} \end{bmatrix} \tag{1}$$

By weighting the supermatrix Q, where $\bar{Q}_{u,k} = y_{u-k}Q_{u-k}$, the weighted supermatrix $\bar{Q}$ was further obtained, as shown in the equation below:

$$\bar{Q} = \begin{bmatrix} y_{1-1}Q_{1-1} & y_{1-2}Q_{1-2} & \cdots & y_{1-v}Q_{1-v} \\ y_{2-1}Q_{2-1} & y_{2-2}Q_{2-2} & \cdots & y_{2-v}Q_{2-v} \\ \vdots & \vdots & \ddots & \vdots \\ y_{v-1}Q_{v-1} & y_{v-2}Q_{v-2} & \cdots & y_{v-v}Q_{v-v} \end{bmatrix} \tag{2}$$

To determine the final weights, the weighted supermatrix underwent normalization. The product of the supermatrix was repeatedly multiplied until convergence to form the limit supermatrix. Each column of the limit supermatrix represents the stable weight distribution of each indicator, reflecting the relative importance of each secondary and tertiary indicator within the entire evaluation system. For instance, the limit supermatrix may show that the level of students' knowledge mastery holds the highest weight among all secondary indicators, indicating its significant impact on the evaluation of the application effects of mobile interactive technology in university sports courses. Specifically, the following processing is required for the weighted supermatrix $\bar{Q}$:

$$\underset{j\to\infty}{LIM}\left(\frac{1}{v}\right)\sum_{j=1}^{v}(Q^j) \tag{3}$$

4 DETERMINATION OF EFFECTIVENESS LEVELS USING THE FUZZY COMPREHENSIVE EVALUATION METHOD

In assessing the effectiveness of mobile interactive technology in university sports courses, the fuzzy comprehensive evaluation method was utilized to determine the effectiveness levels. This method addresses fuzziness and uncertainty, providing a scientific evaluation framework. The following details the four computational steps of the fuzzy comprehensive evaluation method to ascertain effectiveness levels:

Step 1: The evaluation set was established and the survey results were quantified to calculate the membership degree evaluation matrix.

Initially, an evaluation set $X = \{X_1, X_2, X_3 ..., X_v\}$ was defined, representing the grades of excellent, good, average, poor, and very poor, respectively. X_v indicates the level of the evaluated indicator. The constructed membership degree evaluation matrix is as follows:

$$O_{u-k} = \left[O_{u-k/1} \quad O_{u-k/2} \quad O_{u-k/3} \quad O_{u-k/4} \quad O_{u-k/5} \right] \tag{4}$$

For each tertiary indicator, data were collected through questionnaires, expert evaluations, and other methods. This data reflects the membership degree of each tertiary indicator across different evaluation levels. Membership degree denotes the extent to which an indicator belongs to a specific evaluation level. For example, a technological device might exhibit a high membership degree at "excellent" and a lower one at "poor." The following formula calculates the membership degree $O_{u-k/v}$ for an indicator:

$$O_{u-k/v} = \frac{Number\,of\,times\,of\;\;indicator\;Z_{u-k}\;\;at\;score\;v}{Total\,number\,of\,scoring} \tag{5}$$

For each secondary indicator, the membership degree evaluation matrices of all underlying tertiary indicators were aggregated. By employing weighted averages or other methods, the membership degrees of these tertiary indicators were consolidated to produce the membership degree evaluation matrix for the secondary indicators. This matrix reflects the comprehensive membership degrees of the secondary indicators across different evaluation levels. The expression for the secondary indicator membership degree evaluation matrix is as follows:

$$O_u = \begin{bmatrix} O_{u-1/1} & O_{u-1/2} & \cdots & O_{u-1/51} \\ O_{u-2/1} & O_{u-2/2} & \cdots & O_{u-2/5} \\ \vdots & \vdots & \ddots & \vdots \\ O_{u-k/1} & O_{u-k/2} & \cdots & O_{u-k/5} \end{bmatrix} \tag{6}$$

Step 2: Sequential calculation of fuzzy relation evaluation matrices at each level.

Initially, the ANP was utilized to determine the weights of the indicators at each level. The weight matrix for a primary indicator X_u is denoted as $C_{xu} = (C_1, C_2, \ldots, C_K)$, where C_u represents the weight of the secondary indicator Y_u under the primary indicator X_u. Subsequently, the weight matrix for the secondary indicators $C_u = (C_{u-1}, C_{u-2}, \ldots, C_{u-k})$ was calculated, where Z_{u-k} denotes the weight of the tertiary indicator C_{u-k} under the secondary indicator Y_u. For each secondary indicator Y_u, its weight matrix was multiplied by the corresponding membership degree matrix O_u, resulting in the fuzzy relation evaluation vector L_u for the secondary indicator Y_u. This vector integrates the membership degrees of various tertiary indicators across different evaluation levels. For example, if the weight matrix for the secondary indicator of classroom interaction frequency is Y_u and its corresponding membership matrix is O_u, then the fuzzy relation evaluation vector L_u can be represented as follows:

$$L_u = C_u \times O_u \tag{7}$$

For each primary indicator X_u, the fuzzy relation evaluation vectors L_u of all underlying secondary indicators Y_u were aggregated to obtain the fuzzy relation evaluation matrix O_{xu} for the primary indicator X_u. This matrix integrates the fuzzy relation evaluations of all secondary indicators under the primary indicator and can be represented as follows:

$$O_{xu} = \begin{pmatrix} L_k \\ L_j \\ L_m \end{pmatrix} \tag{8}$$

The weight matrix of the primary indicator X_u was multiplied by its fuzzy relation evaluation matrix O_{xu} to produce the fuzzy relation evaluation vector L_{xu}. This vector aggregates the membership degrees of the primary indicator across different evaluation levels. For instance, assuming the weight matrix for the primary indicator of student participation is C_{xu} and its fuzzy relation evaluation matrix is O_{xu}, the fuzzy relation evaluation vector L_{xu} can be represented as follows:

$$L_{xu} = C_{xu} \times O_{xu} \tag{9}$$

Subsequently, the fuzzy relation evaluation vectors L_{xu} of all primary indicators were aggregated to form the target membership degree evaluation matrix O. Based on the principle of maximum membership degree, the effectiveness level of mobile interactive technology in university sports courses can be preliminary determined. For example, if the evaluation matrix O shows the highest membership degree for "excellent," then the effect of the technology in this application can be deemed "excellent."

$$O = \begin{bmatrix} L_{x1} & L_{x2} & L_{x3} & L_{x4} & L_{x5} & L_{x6} & L_{x7} & L_{x8} \end{bmatrix}^S \tag{10}$$

Step 3: A comprehensive evaluation of the effectiveness levels.

According to the evaluation objective, the effectiveness levels were segmented into five stages: 20, 40, 60, 80, and 100. The specific segmentation is as follows:

- Scores below 20 (not including 20): Below the minimum level
- Scores of 20 (including 20) and above, but below 40: Initial level
- Scores of 40 (including 40) and above, but below 60: Repeatable level
- Scores of 60 (including 60) and above, but below 80: Robust level
- Scores of 80 (including 80) and above, but below 100: Quantitative management level
- Scores of 100 (including 100) and above: Optimized level

Based on the established evaluation criteria and segmentation levels, a fuzzy comprehensive evaluation matrix L was constructed. This matrix is composed of fuzzy evaluation vectors for each evaluation indicator, reflecting the scores of different evaluation objects across various indicators. Using the formula below, the target effectiveness level's final score W was obtained by multiplying L with the row matrix V of effectiveness levels. The critical step involves integrating the fuzzy evaluation results with predetermined scoring standards to ascertain the score for each evaluation indicator.

$$W = L \times V \tag{11}$$

5 EXPERIMENTAL RESULTS AND ANALYSIS

Table 1. Summary of teaching effectiveness scores using mobile interactive technology in university sports courses

Primary Indicator	Score	Secondary Indicator	Score	Tertiary Indicator	Score
Teaching effectiveness	64.25	Knowledge mastery of students	60.21	Utilization rate of digital resources	64.21
				Accuracy of knowledge point mastery	57.62
				Self-management of learning progress	57.32
		Skill enhancement	67.59	Frequency of skill practice	64.59
				Accuracy of skill evaluation	7231
		Learning efficiency	69.32	Effectiveness of time management	77.26
				Convenience of accessing learning resources	57.64
				Proactivity in autonomous learning	70.21

According to the data in Table 1, the overall score for the teaching effectiveness of university sports courses utilizing mobile interactive technology is 64.25. Under the primary indicator "teaching effectiveness," the score for knowledge mastery of students is 60.21, with the highest score being for the "utilization rate of digital resources" at 64.21. The score for "accuracy of knowledge point mastery" is 57.62, while the score for "self-management of learning progress" is relatively lower at 57.32. The score for skill enhancement is 67.59, with the "frequency of skill practice" scoring 64.59 and the "accuracy of skill evaluation" achieving the highest score at 72.31. The score for learning efficiency is 69.32, with "effectiveness of time management" scoring the highest at 77.26, whereas the score for "convenience of accessing learning resources" is the lowest at 57.64, and "proactivity in autonomous learning" scores 70.21. Overall, the scores for skill enhancement and learning efficiency are comparatively higher, reflecting the significant impact of mobile interactive technology in these areas. The data indicate that the use of mobile interactive technology in university sports courses notably enhances student skills and learning efficiency. The highest score for the accuracy of skill evaluation suggests that mobile interactive technology provides accurate tools for skill evaluation, thereby improving students' skill levels.

Table 2. Summary of student participation effectiveness scores using mobile interactive technology in university sports courses

Primary Indicator	Score	Secondary Indicator	Score	Tertiary Indicator	Score
Student participation	61.25	Classroom attendance rate	70.22	Use rate of the mobile device check-in system	67.23
				Stability of real-time classroom participation	64.23
				Effectiveness of the pre-class reminder feature	76.54
		Post-class interaction frequency	52.36	Activity level of discussions and Q&A on mobile platforms	54.21
				Completion of online exercises and quizzes	48.23
				Online collaboration in study groups or teams	62.58
		Student feedback proactivity	62.59	Frequency of submitting feedback via mobile apps	79.26
				Detail and constructiveness of feedback content	48.21
				Response and follow-up to feedback results	76.32

According to the data in Table 2, the overall score for student participation in university sports courses utilizing mobile interactive technology is 61.25. Under the primary indicator "student participation," the score for classroom attendance rate is 70.22, with the highest score being for “effectiveness of the pre-class reminder feature” at 76.54, the score for “use rate of the mobile device check-in system” at 67.23, and the score for “stability of real-time classroom participation” at 64.23. The score for post-class interaction frequency is relatively low at 52.36, with “online collaboration in study groups or teams” scoring relatively higher at 62.58, while the score for “completion of online exercises and quizzes” is the lowest at 48.23. The score for student feedback proactivity is 62.59, with the “frequency of submitting feedback via mobile apps” scoring the highest at 79.26, “response and follow-up to feedback results” at 76.32, and “detail and constructiveness of feedback content” scoring the lowest at 48.21. Overall, classroom attendance rate and student feedback proactivity perform well, though post-class interaction frequency needs improvement. The analysis reveals that mobile interactive technology significantly enhances the classroom attendance rate and feedback proactivity. Particularly, the high scores for the pre-class reminder feature indicate that mobile interactive technology effectively reminds students to attend on time, thereby improving attendance rates.

According to the data in Table 3, the overall score for the effectiveness of technology usage in university sports courses utilizing mobile interactive technology is 56.24. Under the primary indicator “technology usage,” the score for the frequency of mobile device usage is 54.23, with the highest score recorded for the “application of mobile devices in classroom activities” at 60.23, while the “frequency of mobile device usage for course learning by students” scores the lowest at 47.25. The score for software operation convenience is 60.12, with “convenience of accessing learning resources” scoring the highest at 72.65, whereas “user interface friendliness” scores the lowest at 51.22. The effectiveness of technical support scores 53.25 with closely ranked scores across its secondary indicators, such as “response speed to technical issues” at 54.15, “efficiency in resolving technical issues” at 54.26, and “diversity of technical support channels” at 52.47. The score for the frequency of technology updates is 56.36, with “adoption of user feedback” scoring the highest at 62.35, and “maintenance of system stability” scoring the lowest at 51.23. The analysis reveals significant room for improvement in the effectiveness of technology usage within university sports courses. Although scoring well in “convenience of accessing learning resources” and “application of mobile devices in classroom activities” at 72.65 and 60.23, respectively, the low score of 47.25 for the “frequency of mobile device usage for course learning by students” indicates a low frequency of mobile device usage by students during regular course learning.

Table 3. Summary of technology usage effectiveness scores using mobile interactive technology in university sports courses

Primary Indicator	Score	Secondary Indicator	Score	Tertiary Indicator	Score
Technology usage	56.24	Frequency of mobile device usage	54.23	Frequency of mobile device usage for course learning by students	47.25
				Application of mobile devices in classroom activities	60.23
				Use of mobile devices in extracurricular sports activities	56.14
		Software operation convenience	60.12	User interface friendliness	51.22
				Convenience of accessing learning resources	72.65
				Smoothness of function operation	52.36
		Effectiveness of technical support	53.25	Response speed to technical issues	54.15
				Efficiency in resolving technical issues	54.26
				Diversity of technical support channels	52.47
		Frequency of technology updates	56.36	Frequency of software feature updates	58.69
				Maintenance of system stability	51.23
				Adoption of user feedback	62.35

Table 4. Summary of teaching interaction effectiveness scores using mobile interactive technology in university sports courses

Primary Indicator	Score	Secondary Indicator	Score	Tertiary Indicator	Score
Teaching interaction	61.23	Interaction frequency between teachers and students	61.33	Number of online discussions and Q&A sessions	76.25
				Real-time classroom interaction	46.32
				Personalized guidance and feedback	53.24
		Interaction among students	63.56	Participation in study group activities	52.36
				Online discussions and exchanges	76.54
		Richness of interaction content	59.36	Diversity of interaction forms	66.21
				Depth of interaction in course content	48.23
				Interdisciplinary and cross-field interactions	64.21

According to the data in Table 4, the overall score for the effectiveness of teaching interaction in university sports courses utilizing mobile interactive technology is 61.23. Under the primary indicator "teaching interaction," the score for interaction frequency between teachers and students is 61.33, with the highest score being for "number of online discussions and Q&A sessions" at 76.25, while the score for "real-time classroom interaction" is the lowest at 46.32. The score for interaction among students is 63.56, with "online discussions and exchanges" scoring the highest at 76.54, and "participation in study group activities" scoring lower at 52.36. The score for the richness of interaction content is 59.36, with "diversity of interaction forms" scoring 66.21, "interdisciplinary and cross-field interactions" scoring 64.21, and "depth of interaction in course content" scoring the lowest at 48.23. The analysis reveals that the overall effectiveness of teaching interaction using mobile interactive technology in university sports courses is generally good, particularly in "number of online discussions and Q&A sessions" and "online discussions and exchanges," which scored 76.25 and 76.54, respectively, indicating that mobile interactive technology is highly effective in fostering online interaction and discussion. However, the low score for "real-time classroom interaction" at 46.32 suggests that the effectiveness of real-time interaction via mobile interactive technology in actual classroom settings needs improvement.

According to the data in Table 5, the overall score for learning motivation in university sports courses utilizing mobile interactive technology is 64.25. Under the primary indicator "learning motivation," the score for learning interest is 57.24, with the highest score being for "reward mechanisms in the learning process" at 64.32, while the score for "interactivity and enjoyment of learning content" is the lowest at 56.23. The score for autonomy in learning is 69.33, with "utilization of autonomous learning resources," scoring the highest at 77.58, and "time management and study planning" scoring 72.36. The score for clarity of learning objectives is 64.12, with "tracking of goal achievement" scoring 70.21, whereas "clarity of goal setting" scores lower at 57.12. The analysis indicates that mobile interactive technology effectively enhances students' autonomy in learning within university sports courses, particularly in "utilization of autonomous learning resources" with a score of 77.58, demonstrating that students are effectively utilizing resources provided by mobile platforms to enhance their autonomous learning outcomes. Additionally, the reward mechanisms in the learning process play a significant role in enhancing learning interest, scoring 64.32.

Table 5. Summary of learning motivation effectiveness scores using mobile interactive technology in university sports courses

Primary Indicator	Score	Secondary Indicator	Score	Tertiary Indicator	Score
Learning motivation	64.25	Learning interest	57.24	Interactivity and enjoyment of learning content	56.23
				Opportunity for autonomous selection of learning content	57.41
				Reward mechanisms in the learning process	64.32
		Autonomy in learning	69.33	Time management and study planning	72.36
				Utilization of autonomous learning resources	77.58
		Clarity of learning objectives	64.12	Clarity of goal setting	57.12
				Tracking of goal achievement	70.21
				Feedback after goal achievement	68.26

According to the data in Table 6, the overall score for the effectiveness of teaching resources in university sports courses utilizing mobile interactive technology is 57.24. Under the primary indicator “teaching resources,” the score for the diversity of resources is 64.23, with the highest score being for “diversity of sports projects” at 76.25, while the score for “flexibility in resource usage” is the lowest at 50.21. The score for the frequency of resource updates is 59.12, with “notification mechanisms for resource updates” scoring the highest at 72.31, yet the score for “timeliness of resource content updates” is comparatively lower at 48.36. The score for the applicability of resources is 46.25, marking the lowest scoring primary indicator, with “suitability of resources for different student levels” scoring the lowest at 38.65. The score for the quality of resources is 58.36, with “user experience of resources” scoring relatively high at 67.32, whereas “scientificity and precision of resources” scores lower at 48.26. The analysis shows that while mobile interactive technology exhibits strengths in providing diverse sports projects and updating resource notifications effectively, there are notable deficiencies in real-time classroom interactions and the flexibility of resource usage. The high scores for the diversity of sports projects at 76.25 indicate a strong performance in offering varied sports activities, showcasing the strengths of mobile interactive technology in enhancing the diversity of teaching resources.

Table 6. Summary of teaching resource effectiveness scores using mobile interactive technology in university sports courses

Primary Indicator	Score	Secondary Indicator	Score	Tertiary Indicator	Score
Teaching resources	57.24	Diversity of resources	64.23	Richness of resource types	64.21
				Diversity of sports projects	76.25
				Flexibility in resource usage	50.21
		Frequency of resource updates	59.12	Timeliness of resource content updates	48.36
				Introduction of new resources	57.32
				Notification mechanisms for resource updates	72.31
		Applicability of resources	46.25	Match of resources with course objectives	46.59
				Suitability of resources for different student levels	38.65
				Applicability of resources in different learning environments	49.21
		Quality of resources	58.36	Scientificity and precision of resources	48.26
				Practicality and operability of resources	55.36
				User experience of resources	67.32

According to the data in Table 7, the overall score for the effectiveness of teaching evaluation in university sports courses utilizing mobile interactive technology is 56.32. Within the primary indicator "teaching evaluation," the score for the scientificity of the evaluation system is 54.23, with the highest score being for "comprehensiveness of evaluation content" at 67.12, while the score for "objectivity and rationality of evaluation standards" is notably low at 38.26. The score for fairness of evaluation results is 57.24, with "equality of student feedback" scoring 59.36, but the score for "transparency of data processing" is lower at 54.23. The score for timeliness of evaluation feedback is 55.34, with "responsiveness of teachers to student feedback" scoring 60.12, yet the score for "frequency of feedback updates" is relatively lower at 51.56. The score for coverage of evaluation feedback is 60.12, with "accessibility of feedback" scoring higher at 67.23, whereas "personalization of feedback" scores lower at 47.25. The analysis indicates that there are significant shortcomings in the teaching evaluation effectiveness of mobile interactive technology in university sports courses. The particularly low score for "objectivity and rationality of evaluation standards" at 38.26 suggests potential subjective biases and irrationalities within the evaluation system design, impacting the fairness and scientific nature of the evaluations. Despite the high score for "comprehensiveness of evaluation content," which shows that the evaluation system covers course content extensively, the lower score for "diversity of evaluation methods" at 54.11 points to the need for incorporating a wider variety of evaluation methods to meet diverse student needs.

Table 7. Summary of teaching evaluation effectiveness scores using mobile interactive technology in university sports courses

Primary Indicator	Score	Secondary Indicator	Score	Tertiary Indicator	Score
Teaching evaluation	56.32	Scientificity of the evaluation system	54.23	Objectivity and rationality of evaluation standards	38.26
				Comprehensiveness of evaluation content	67.12
				Diversity of evaluation methods	54.11
		Fairness of evaluation results	57.24	Transparency of data processing	54.23
				Consistency of evaluation standards	
				Equality of student feedback	59.36
		Timeliness of evaluation feedback	55.34	Instant feedback functionality	58.32
				Frequency of feedback updates	51.56
				Responsiveness of teachers to student feedback	60.12
		Coverage of evaluation feedback	60.12	Comprehensiveness of feedback coverage	62.32
				Personalization of feedback	47.25
				Accessibility of feedback	67.23

According to the data in Table 8, the overall satisfaction score in university sports courses utilizing mobile interactive technology is 60.21. Within the primary indicator "overall satisfaction," student satisfaction scored the highest at 67.58, with "learning experience satisfaction" scoring 72.21 and "technical support satisfaction" scoring 69.25. However, "learning effectiveness satisfaction" was relatively low at 62.35. The teacher satisfaction score is 57.26, with a higher score of 70.14 for "teaching tool satisfaction," but the lowest score of 42.36 for "student interaction satisfaction." The university satisfaction score is 60.23, with a high score of 67.26 for "teaching quality monitoring satisfaction" and a low score of 52.48 for "course management satisfaction." The platform satisfaction score is 53.23, with "user interface satisfaction" and "functional implementation satisfaction" relatively high at 55.26 and 54.12, respectively, while "technical performance satisfaction" has the lowest score at only 46.32. It can be seen from the above data analysis that the overall satisfaction effectiveness of mobile interactive technology in university sports courses is relatively moderate, with significant advantages and disadvantages. The student satisfaction score is the highest, especially with scores of 72.21 for "learning experience satisfaction" and 69.25 for "technical support satisfaction," indicating that students are quite satisfied with the effectiveness of mobile interactive technology in improving learning experience and technical support. However, teacher satisfaction is relatively low, especially with a score of only 42.36 for "student interaction satisfaction," indicating that teachers are not very satisfied with the effectiveness of mobile interactive technology in classroom interaction, which needs further improvement to enhance the quality of interaction.

Table 8. Summary of overall satisfaction scores using mobile interactive technology in university sports courses

Primary Indicator	Score	Secondary Indicator	Score	Tertiary Indicator	Score
Overall satisfaction	60.21	Student satisfaction	67.58	Learning experience satisfaction	72.21
				Learning effectiveness satisfaction	62.35
				Technical support satisfaction	69.25
		Teacher satisfaction	57.26	Teaching tool satisfaction	70.14
				Student interaction satisfaction	42.36
		University satisfaction	60.23	Technical support satisfaction	62.31
				Course management satisfaction	52.48
				Teaching quality monitoring satisfaction	67.26
		Platform satisfaction	53.23	User interface satisfaction	55.26
				Function implementation satisfaction	54.12
				Technical performance satisfaction	46.32

6 CONCLUSION

This study systematically evaluated the effectiveness of mobile interactive technology in university sports courses by constructing a scientific effectiveness evaluation model. The specific content includes three parts: firstly, the construction of an effectiveness evaluation model and the establishment of an evaluation index system; secondly, the calculation of the weights of each indicator to ensure the objectivity and scientificity of the evaluation; and finally, the fuzzy comprehensive evaluation method was used to determine the effectiveness level and provide comprehensive evaluation results. The experimental results cover multiple aspects, including teaching effectiveness, student engagement, technology use, teaching interaction, learning motivation, teaching resources, teaching evaluation, and overall satisfaction. The comprehensive experimental results show that the application of mobile interactive technology in university sports courses has achieved certain results. In terms of teaching resources, the diversity and quality of resources are prominent, but the applicability of resources needs to be improved. In terms of teaching evaluation, the comprehensiveness of evaluation content and the timeliness of feedback score high, but there are shortcomings in the scientificity of the evaluation system and the personalization of feedback. In terms of overall satisfaction, students have a higher level of satisfaction with mobile interactive technology, especially in terms of learning experience and technical support, but teachers have a lower level of satisfaction with student interaction and platform technical performance.

This study first constructed a systematic effectiveness evaluation model by combining multi-dimensional evaluation indicators, providing a scientific basis for evaluating the effectiveness of mobile interactive technology in university sports courses. Through a comprehensive evaluation of multiple aspects, the results of this study provide specific improvement directions for universities to further optimize the application of mobile interactive technology, which helps to enhance the quality of course teaching and student learning experiences.

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8 AUTHOR

Man Peng, a graduate of Hebei Normal University with a Master's degree in Sports, and is currently employed at Shijiazhuang Vocational and Technical College. Her main research interests are physical education and vocational education (E-mail: 2004110441@sjzpt.edu.cn; ORCID: https://orcid.org/0009-0005-7104-825X).