International Journal of Education and Practice
2026 Vol. 14, No. 1, pp. 454-473
ISSN(e): 2310-3868
ISSN(p): 2311-6897
DOI: 10.18488/61.v14i1.4760

Developing a modernization evaluation index: A targeted assessment of physical education modernization in Nanchong high schools

Jien Zeng[1,2]
Aida Hanim A. Hamid[1]
Qiaoyi Yang[2]
Jie Liu[2]
Siqi Pu[3+]

[1]*Faculty of Education, National University of Malaysia (UKM),43600, Bangi, Selangor, Malaysia.*
[1,2]*Email: engjack123@163.com*
[1]*Email: aidahanim@ukm.edu.my*
[2]*Nanchong Vocational and Technical College. No. 94, Hongfa Road, Xiaolong Street, Gaoping District, Nanchong City, China.*
[2]*Email: kyoyiyang@gmail.com*
[2]*Email: Ljdyx5566@163.com*
[3]*Xihua Normal University, No.1 Shida Road, Shunqing District, Nanchong City, Sichuan Province, China.*
[3]*Email: 18882338318@163.com*

(+ Corresponding author)

Article History
Received: 9 May 2025
Revised: 11 December 2025
Accepted: 15 January 2026
Published: 10 February 2026

Keywords
Delphi method
Educational quality
Educational reform
Physical education modernization
Program evaluation.

ABSTRACT

This study aims to construct and validate a modernization evaluation index for physical education programs in high schools within the Nanchong area, focusing on optimizing educational quality and program effectiveness. Using a Delphi method, this cross-sectional study recruited ten experts from the fields of education and physical education to select all the necessary indicators that should be used in modernization evaluation. It used three phases of surveys where the particular experts judged the relevance and importance of the mentioned factors towards physical education modernization. The data was collected to some extent for each indicator and then refined through successive rounds of feedback in order to establish the most important indicators. Specific findings highlighted from the study include infrastructure upgrade, curriculum development, and the integration of technology for modern learning as the key pillars of modern learning. Accessibility to learning facilities and curriculum was considered critical and an essential component of the study. Moreover, the interviewed specialists stressed that ongoing improvements in educational practices are indispensable for educators to adopt new approaches to teaching. Safety measures and mental health were identified as two significant concerns, with respondents expressing high levels of consensus about the frequency of assessments required to modify and enhance learning approaches. The modernization assessment index was validated and provides a clear and practical plan for improving physical education programs' technology, safety, and content. Future research should expand this study's geographical and educational findings to make them more helpful.

Contribution/Originality: This study is one of the few that have explored the establishment of a physical education modernization evaluation index based on the Delphi method, where expert consensus, weight factors judgment, and the contextual indicators specific to high schools in Nanchong, China, were integrated.

1. INTRODUCTION

1.1. Background

The reform and enhancement of physical education (PE) in high school have become one of the main issues discussed within the framework of current educational change and development processes in different countries, including China. As China continues its efforts to improve the quality and outcomes of its education, the

modernization of physical education has become a critical aspect of that change. The Chinese government has implemented several reforms toward educational modernization, calling for educational practices that are sustainable for contemporary society and meet the needs of the 21st-century learner (Zhu, 2019). This is not just about the introduction of new technologies or innovative teaching practices, but rather a system that encompasses curriculum content, faculty development, and learning climate (Wu, Wu, & Li, 2021). Nevertheless, the process of achieving efficient modernization is not easy. Some of the most significant challenges educators are trying to solve are the following: deciding on the specifics of the meaning of a modernized PE program. There is no clear definition of modernization that would be acceptable to all schools and regions, which creates methodological problems in the evaluation of the process and its results (Zhu, 2019). In addition, embracing innovations in teaching and teaching evaluation remains a challenge since many teachers continue to apply traditional teaching and learning techniques that do not espouse modern humanist values (Wu et al., 2021; Zhao & Gudamu, 2021). This gap between what is traditionally expected and what is expected given current societies can pose a barrier to the management and development of PE programs, leading to a gap between the educational and taught curriculum (Griggs & Fleet, 2021).

Besides these challenges, there are social factors that hinder the management of PE modernization, especially from teachers, administrators, and parents. Lack of preparedness and feelings of inadequacy when it comes to teaching practices constitute core challenges that many instructors share (Wu et al., 2021; Xiaofei, Korobeinik, & Kozina, 2021). This resistance could be due to a perceived misunderstanding of the importance of modernization or a resistance to the unknown, where there might be an unwillingness from the subject to change methodologies (Hall-López, 2021). Additionally, the assessment of the effectiveness of PE programs also presents a major challenge because commonly used evaluation techniques may not align with modern approaches to training (Yu, Xing, & Liu, 2024). This requires the construction of a comprehensive evaluation index system to assess the modernization of PE programs based on curriculum content, teaching modes, and students' activity focus (Xiaofei et al., 2021; Yu et al., 2024). Therefore, the purpose of the present study is to construct a systematic modernization evaluation index in high schools in the Nanchong area. The objective of the proposed research is to discover the sources of potential weight of the important indicators that will portray the modernization of PE programs and to construct a favorable perspective of weights for the evaluation of PE programs. In this regard, the study aims to contribute useful recommendations on how physical educators and policymakers can improve the quality of PE and achieve positive outcomes for students within a dynamic educational environment.

1.2. Research Aim and Questions

The purpose of this study is to devise an evaluation index that quantitatively estimates the degree of modernization of the physical education program in a high school located in the Nanchong area. The aim of this is to explore the relevant factors for the successful modernization of physical education and to evaluate the results on the educational quality of these factors.

Now, the research questions for this research are given below:

RQ1: What are the key indicators for evaluating the modernization of physical education programs in high schools in Nanchong?

RQ2: How can these indicators be effectively weighted to develop a comprehensive modernization evaluation index?

1.3. International Relevance of Physical Education Modernization and Its Implications for Global Educational Reform

Over the last decade, the improvement and advancement of physical education (PE) programs as a fundamental component of education have become an important issue worldwide due to countries' competitive desire and commitment to providing education in the twenty-first century. Although this study focuses on the Nanchong area in China, the contextual problems and managerial dilemmas presented are global in nature. The stipulations for a

more analytical and methodical approach to assessing the modernization of the PE curriculum are significant for educators and policymakers globally. In this respect, the results of the study, which indicate the primary areas of focus including infrastructure and learning environment enhancements, curricula and learning material creation, and the adoption of technologies are generalizable to any country aiming to renew education. Additionally, the study addresses issues also seen in many countries, including resistance to change and the lack of preparedness among educators. This confirms the general applicability of the study's findings and the usefulness of the insights produced regarding the nature of educational systems and how they might be improved to meet the demands of current learning environments.

It is also highly relevant for global contexts because the research's evaluation index of modernization is based on Delphi's approach to model construction. Their clear framework highlights the potential for versatility in implementation across cultures and educational environments. In identifying these fundamental elements of modernization in physical education (PE), the current study offers a framework that could be used by other regions or countries to evaluate and enhance their own PE programs. Given the trends of developmental changes in educational systems at the international level, where health, safety, and student engagement are increasingly prioritized, the findings of the present study provide a strategic reference for international educational planners, policymakers, and physical educators worldwide. Thus, apart from contributing to the development of PE programs in China, the study's findings serve as a valuable resource for ongoing educational reforms aimed at improving the quality of physical education globally.

2. LITERATURE REVIEW

2.1. Impact of Modern Infrastructure on Physical Education Outcomes

The connection between contemporary structures and PE practice and quality is a major focus of educational research, especially in China. The application of more contemporary infrastructures and facilities, advanced equipment, and information technologies is assumed to have shared positive impacts on improving students' interest, achievement, and educational benefits. This literature review analyzes different works that investigate these relationships with reference to both the advantages and disadvantages of current structural development in PE. Jajang, Purwanto, Nanda, and Novriansyah (2021) also highlight one of the ways to enhance the quality of segments of physical education in state junior high schools through having effective facilities and infrastructure. According to the researchers, effective management contributes to the achievement of educational goals because the infrastructure provided ensures learning as well as accommodates physically active students. According to their studies, schools with well-equipped gymnasiums and the most up-to-date equipment claim higher students' interest and enthusiasm. However, this research also shows that access to 'modern' technology is inadequate; efficient and appropriate use of these resources is essential in determining MSR on educational performance.

In another study, Nova, Syahputra, Roberto, Surimeirian, and Nofrizal (2023) examine the research topics related to the degree of standardization of teaching facilities in Physical Education at elementary schools in Langsa City, Indonesia. In this regard, the research highlights the fact that the quality of learning infrastructure is a critical determinant of educational performance. According to Nova et al. (2023), schools with deficient infrastructure struggle to provide proper PE programs, resulting in decreased learner participation and reduced motivation. This research shows that contemporary tools can improve learning processes; however, the distribution of resources only widens the divide that separates more and less financially endowed schools. On the other hand, Brannagan and Grix (2023) expand the study of physical education infrastructure to national security and economic issues in Russia. This study also shows that, on the same basis, investment in sports facilities fosters exercise as well as the establishment of human capital, which is crucial for the country's competitiveness. This leads to a belief in the longevity of development in physical education, with a range of social implications extending well beyond the standard

pedagogical impact of infrastructure provision. However, the researchers note that such infrastructure may not enhance the same quality of learning outcomes in all regions if there is no planned investment and growth.

Digital technologies in physical education have also been an area of interest in the study initiatives. As modern educational technologies are considered in Yao (2023), it is possible to discuss the positive impact of such tools on increasing the effectiveness as well as the quality of physical training. This paper presents a pattern where the use of applications, including three fitness tracking applications and an online resource, increases students' interest and motivation when the teacher uses such tools. However, Yao (2023) also explains that even here, numerous teachers struggle with the integration of such technologies, pointing to obsolescing practices and low training, which can counteract the positive impact of modern structures. Furthermore, Piñeiro-Cossio, Fernández-Martínez, Nuviala, and Pérez-Ordás (2021) discusses the rationale for standards for PE facilities and infrastructure that must not be compromised. From the perspective of findings, it is seen that a healthy school environment supplemented by necessary facilities may raise students' fitness levels and improve academic achievement too. However, the study also notes that infrequent replacement and maintenance of such equipment contribute to the wear and tear of the facilities, which consequently leads to low morale and productivity among students as a result of poor exercise opportunities. On the other hand, Shirotriya, Dixit, and Jaiswal (2024) target the implications of physical education in enhancing the health status of especially needy students. The authors also posit that current structures must reflect diverse populations of students as well as flexibility. They underline the fact that although the facilities in the present day can contribute to the effectiveness of participation, these need to be developed in a manner that can address the requirements of students with different capabilities and medical issues for special needs for physical education for all. This touches on an important topic in infrastructural development, for instance, the aspect of integrating infrastructure such as affordable designs. Consequently, the literature suggests that contemporary facilities bear the responsibility of defining physical education results.

2.2. Evaluation Indicators in Physical Education Modernization

Gradual changes in the structure of PE systems require the development of substantial assessment criteria that may efficiently evaluate the accomplishments of PE as an academic subject. Prior research reviews current scholarly work on the indices used in evaluating modernization in PE programs concerning the methods applied in their implementation, efficacy, and identification. A major study by Nova et al. (2023) focuses on research related to the construction of evaluation indexes for Physical Education reform and development in Chinese universities. The authors describe aspects such as the content relevance of studied material, the choice of teaching methods, and students' activity. Based on their findings, the authors believe that these indicators are useful for analyzing the process of modernization. However, the study also reveals that it is difficult to standardize these indicators so that they fit a given institution, since what works in one institution may not work in another. The above-mentioned adaptability issue raises questions about whether the indicators can be useful across different educational settings. In a similar vein, Lindsay and Otero (2023) discuss the use of technology as one of the signs of modernization in PE. The research supports the view that technologies and digital media should be integrated into the learning-teaching process. The authors discovered that the implementation of technology in lessons reflected increased student engagement and satisfaction. However, they also pointed out that such an approach causes inequity and is especially negative in underfunded schools where inadequate resources like technologies are available. Therefore, the discrepancy raises the necessity of a cautious approach to equity when choosing indicators of modernization.

There is another essential view on modernization indicators presented by Jajang et al. (2021), which discusses facilities and infrastructure as components of PE modernization. According to their studies, quality teaching and learning environments, particularly well-maintained facilities, enhance quality physical education. But they also state that having modern facilities on its own does not help raise the rates of success; what matters is how those assets are managed and used. This implies that, though infrastructure is an important measurable factor, it should not be

developed in isolation from leadership and strategic development. Similarly, Bungum, Bøe, and Henriksen (2018) note that teacher qualifications and professional development are part of modernization in Physical Education. The findings of the study indicate that teacher training in advanced teaching techniques ensures the adoption of best practices in class, leading to improvements in the quality of education. However, the research also shows that the lack of professional development opportunities for many educators persists because these stakeholders are hamstrung by time and, sometimes, the lack of institutional support. This raises the question of whether the modernization agenda can be sustainable if human resources are not developed alongside the fixed infrastructure. The approaches adopted in choosing and confirming such indicators are also very important. In a mixed-methods study, Kersting, Schrocker, and Papantoniou (2021) assess the suitability and generalization of varied indicators across various educational settings. From the study, they argue that engaging stakeholders, teachers, students, and other administrators helps in identifying relevant and accepted indicators. However, the study also shows that the process of arriving at a shared understanding with multiple and often conflicting stakeholders can be complicated, which might slow the advancement of modernization programs. Furthermore, Shirotriya et al. (2024) rightly underlined the absence of a framework to assess the degree and effectiveness of PE modernization. According to the study, there is a possibility that schools find it hard to put in place the right evaluation practices in the absence of concise guidelines. This unwillingness has resulted in some inconsistencies in the measurement and reporting of modernization, so the comparability of outcomes is problematic across institutions. The authors only suggest the use of detailed multiple indicators, but at the same time, they stress the need for flexibility which is needed to take into account the contexts of different countries. For this reason, the literature shows that the assessment criteria for the modernization of physical education are complex and the selection and validation of such indicators are crucial.

3. METHODOLOGY

3.1. Research Design

This research employs a cross-sectional study design to assess the process of modernization of physical education programs in high schools in Nanchong. This design makes it possible to evaluate the state of affairs of the modernization of physical education at a given time within the various schools. This approach makes it easier to gather data on the current trends in the different aspects of modernization, including infrastructure modernization, curriculum modernization, and the teaching methods used to offer learning. This study uses a structured communication technique called the Delphi method to solicit the opinions of experts on the indicators that define modernization. This comprises sequential questioning where key stakeholders offer opinions, and the outcomes form the basis for further questions until convergence (Li & Hu, 2023). This iterative process aids in obtaining a consensus on each indicator's weighting towards a fully developed Modernization Evaluation Index that is comprehensive and grounded in expertise.

3.2. Data Collection

Data for this study were collected through the Delphi technique, a rigorous forecasting method that uses a panel of experts. The Delphi technique is developed to obtain judgments from a panel of experts by conducting sequential questionnaires with controlled feedback, with the aim of reaching convergence on particular real-world issues or changes. The Delphi approach was applied in this research to improve and verify an evaluation index for the modernization of physical education in Nanchong High School. This process comprises several critical phases, which are discussed (Figure 1).

3.3. Selection of Experts

In the Delphi study process, the first and most important step was the identification of the panel of experts, who have relevant background knowledge and experience with the modernization of physical education. These

participants were selected from physical education teachers, school leaders, education policymakers, and academicians in sport education. It was essential to come up with a balance of the panel, as the more diverse the views of the different stakeholders involved in the educational and physical education processes, the wider the range of geographical, institutional, and experiential backgrounds that have to be considered.

3.3.1. First Round: Open-Ended Questionnaire

In the first step, a comparative analysis of data from cross-country studies and an analysis of national curricula was conducted to design an initial questionnaire. Therefore, the questionnaire aimed at obtaining generic information on what the experts considered important when modernizing physical education. All the questions posed were general, encouraging respondents to provide elaborate responses. These questions were presented in a questionnaire format to gather the experts' opinions, and the administered questionnaire was anonymous.

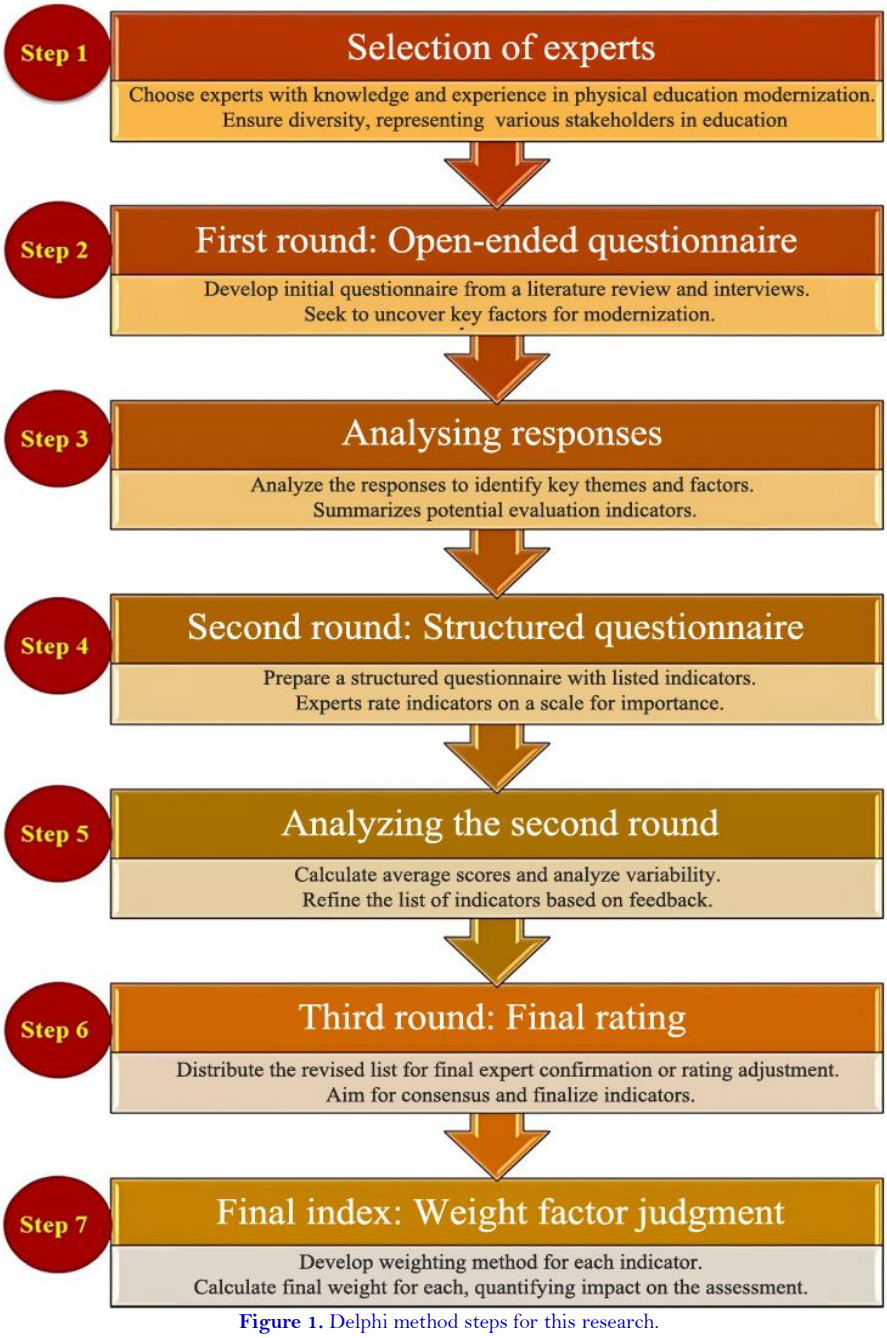

Figure 1. Delphi method steps for this research.

3.3.2. Analyzing Responses

While aggregating the responses at the end of the first round, the answers were carefully scrutinized for recurring patterns and essential factors as mentioned by the expert resources. This process entailed ordering types and transforming the qualitative data into a straightforward list of possible evaluation indicators. These indicators were based on the frequency and distribution of the response patterns of the identified experts so that they form the basis for the subsequent survey.

3.3.3. Second Round: Structured Questionnaire

The knowledge obtained from the first round helped to prepare a structured questionnaire that included the listed indicators. The experts were also asked to provide a qualitative estimation of each indicator depending on its relevance to the process of modernization, where the scale varied from 1 to 5. The questionnaire also contained fields for the experts to evaluate each indicator and express whether they would like to improve it or should add some more indicators that were not discussed earlier.

3.3.4. Analyzing the Second Round

The findings from the second round involved a summation of the scores and the subsequent calculation of the average for each assessed indicator.

3.3.5. Third Round: Final Rating

In the third round, the list comprising revised indicators was returned to the experts. Their raters were also asked to verify the tables' applicability or modify their ratings according to a brief review of the group feedback. This final round proved to be crucial in achieving a strong consensus to select the appropriate set of indicators that could be used in the construction of the evaluation index.

3.3.6. Weight Factor Judgment

Finally, a method was adopted to allocate weight to each of the indicators, a feature expressing the relative significance of an indicator compared with other indicators as arrived at by experts. Among them, expert judgment such as pairwise comparison and direct weighting was employed. Such weights were then summed up to arrive at the final weights, which allowed for a measure of the significance of the different indicators in the assessment of modernization in physical education programs.

3.4. Research Participants

The target population of this study was 10 participants, selected from different educational and sports abilities associated with the high school system in Nanchong City. The following people were selected based on their depth of understanding and valuable input in physical education so as to get a balanced and inclusive panel of experts relevant to this field. The participants involved the Director and Deputy Director General of Nanchong Education and Sports Bureau, the School Sports Team Leaders, Games Masters, and a Physical Education Teacher who has participated in the management of schooling protection sports (Table 1). The subjects in the study were selected through a snowball sampling method whereby the initial respondents were attained by personally contacting officials in the education sector within the Nanchong region, who in turn helped identify further subjects for the study. This method facilitated the feature that guarantees that the panel entails individuals with adequate subject-matter expertise in the modernization of physical education as well as a direct connection to or influence of policy and implementation of policies in this area (Parker, Scott, & Geddes, 2019). Concerning academic qualifications, most of the experts held a master's degree, and a few possessed a doctoral candidacy, which indicates that their level of education was sufficiently high to correspond with their professional activity. Although their ages varied widely, this diversity

ensured that the committee had a range of experience and could offer various perspectives, which is important when applying the Delphi method used in this study. These diverse and experienced participants provided valuable insights and essential judgment to formulate the Modernization Evaluation Index of physical education programs in Nanchong High Schools.

Table 1. Details of Research Participants.

Serial number	Expert post	Work unit
1	Sports team leader	Nanchong City Senior High School
2	Games master	Nanchong No.9 Middle School
3	Director	Nanchong City, Education and Sports Bureau
4	Deputy director general	Nanchong Education and Sports Bureau
5	Director	Nanchong Education and Sports Bureau
6	Sports trainer	Nanchong City Senior High School
7	Sports Team Leader	Nanchong City Baita Middle School
8	Games master	Nanchong City Baita Middle School
9	Physical education teacher	Nanchong City Senior High School
10	Headmaster	Nanchong City Baita Middle School

3.5. Research Instrument

In this study, the Delphi method was used as the main tool to improve and verify the evaluation index of the modernization of physical education in Nanchong High School. The first step of the Delphi process was the open questionnaires, which are intended to solicit broad stimulating data from the key informants chosen. The areas of requirements addressed in the questionnaire ranged from infrastructure issues to curriculum and instruction issues, issues concerning the development of teachers and students, institutional, community, technology, safety, and assessment issues in this area of physical education. Other questions were also added to assess major concerns and best practices across the physical education sector in Nanchong. The responses obtained during the first round were used to develop hypotheses about modernization, out of which a structured questionnaire for the second round was developed. This questionnaire consisted of 16 survey questions, and all these questions were designed with the help of indicators that were extracted from the feedback received during round one. The experts were also requested to rate the above-mentioned indicators using the Likert scale of 5, which includes the indicators of very important to not important. The last round of the questionnaire modification involved 11 questions in total, all of which matched a single specific indicator for the evaluation index. The third and final questionnaire was also on a five-point Likert scale to ensure that the final determination of the importance and relevance of each identified indicator was arrived at based on consensus. The Delphi method employed here provided a structured approach to evaluate each of the indicators and helped in developing an effective evaluation index for the modernization of physical education in high schools in Nanchong.

3.6. Data Analysis

Data for this study involved a Delphi method where data collected was categorized into subsets for analysis and refinement of the various sub-indices that constitute the evaluation index for the modernization of physical education. First of all, qualitative information gathered from the first round was analyzed by applying the results of thematic analysis. This made it easier, in turn, to identify recurrent patterns and themes to establish a firm baseline for proposing potential evaluation indicators. Second, qualitative survey data analysis of the data collected during the first round of survey responses was conducted quantitatively. Each response was quantized, and the mean value for each of the potential indicators was estimated. This average was then used to calculate the total score percentage each of the indicators contributed to achieving this, thereby identifying the extent to which the panel of experts regarded the indicators as essential. As part of the final stage in the analysis, the Weight Factor Judgment method was used to

provide the definitive weighting of each of the indicators prior to validation. This method extended through several activities, which embedded certain important steps.

First, scores for each line index were calculated based on pairwise comparisons among the indicators, as detailed by the experts. This has been calculated using the formula below:

$$DiR \sum_{i=1}^{n} = aij \ (j \neq i)$$

In this formula, a_{ij} indicates the score assigned when comparing two indicators, where i and j are different evaluation indices. The Line Index DiR is calculated for each indicator i by summing all the scores a_{ij} obtained from comparisons with other indicators j for a specific round R by an expert. Moreover, n is the total number of indicators being compared, and j runs through all indicators except i itself.

Second, once each line index DiR is calculated for each expert, the next step is to find the average score pi for each indicator i. This is done by averaging the line indexes DiR across all experts L who participated in that round of the Delphi study.

$$pi = \sum_{R=1}^{L} \frac{D_{iR}}{L}$$

The final weight for each indicator is calculated using the average score *pi*. The weight *wi* for an indicator is its average score divided by the sum of the average scores of all indicators. This normalization ensures that the sum of all weights equals 1, thereby allowing the weights to be directly comparable and interpretable as proportions.

$$wi = \frac{Pi}{\sum_{i=1}^{n} Pi}$$

3.7. Ethical Consideration

In this research, strong ethical principles were followed to ensure that the rights and best interests of the expert participants were well protected. All participants were provided with a copy of the Information Sheet and Consent Form, which contained a brief description of the study, the role that participants would have to play, and what would be done with the information collected from them. Coordination with the identified experts was made to explain that their participation was voluntary, and they could discontinue at any time without any consequences. This level of disclosure ensured ethical practice, mutual trust, and, therefore, the credibility of the collected data and overall findings of the study.

Table 2. Demographic information about Participants.

Factor	Attribute	Frequency	Percent %	Mean	Standard deviation
Age	36-40 years	5	50.0	3.80	1.03
	41-45 years	3	30.0		
	46-50 years	1	10.0		
	51-55 years	1	10.0		
	Total	10	100.0		
Gender	Male	6	60.0	1.40	0.52
	Female	4	40.0		
	Total	10	100.0		
Highest academic level	Master's degree college	7	70.0	2.30	0.48
	Doctoral candidate	3	30.0		
	Total	10	100.0		
Years of experience	5-6 Years	3	30.0	3.70	0.48
	More than 6 years	7	70.0		
	Total	10	100.0		

4. FINDINGS

4.1. Analysis of Demographic Data

The demographic breakdown of the data table includes a small sample of 10 participants, primarily distributed across various age groups from 36 to over 55 years (Table 2). Participants aged 36-40 are the most represented, accounting for 50% of the total (5 participants), with an average response score of 3.80 and a standard deviation of 1.03, indicating notable variability in their responses. The next significant group includes individuals aged 41-45, making up 30% of the sample (3 participants), though specific average responses and variability measures are not reported for this group. The 46-50 and 51-55-year age groups are the least represented, each comprising 10% of the sample (1 participant each), with no response scores provided. In terms of gender distribution, males form the majority, making up 60% of the participants (6 participants), and have a more consistent response pattern with an average score of 1.40 and a standard deviation of 0.52. Females represent 40% of the sample (4 participants), but detailed response scores are not available for this group. Regarding academic achievement, 70% of the participants (7 participants) have a master's degree from a college, with an average response score of 2.30 and a standard deviation of 0.48, indicating moderate consistency in their responses. The remaining 30% are doctoral candidates (3 participants), but their response scores have not been detailed. The experience level among the participants shows that those with more than 6 years of experience are predominant, making up 70% of the sample (7 participants). Participants with 5-6 years of experience account for the remaining 30% (3 participants) and have a higher average response score of 3.70 with a standard deviation of 0.48, suggesting fairly consistent responses within this group.

Delphi Method Round 1: Thematic Analysis of Open-Ended Questions.

Theme 1: Infrastructure and Facilities.

Infrastructure, which is fundamental, must exist in any physical education program to be meaningful. Contemporary PE facilities must provide for many sporting disciplines together with recreation; their physical structure should include indoor and outdoor spaces to allow the teaching of physical education in all seasons. According to Participant 10, there is a great need for multi-purpose facilities, as he mentioned, "We also need good standard sporting fields, flexible space for play, and indoor gyms with quality exercising amenities." This stresses the need to have facilities that are equipped and inclusive of facilities that can allow PE activities to continue even in the worst weather conditions and the like. As stated by Participant 1, "Partnerships with local sports organizations to access external facilities," are another factor that influences the opportunities available for students since the school by itself might not be able to provide extra facilities.

Theme 2: Curriculum and Instruction.

There is a need for curriculum design in physical education since students are differently endowed, as well as considering the national curriculum requirements. Selecting a wide variety of activities, including team sports and fitness technologies, assures that everybody gets interested and engages in practice. Participant 2 added, "Curricula should include life skills; teamwork, and sportsmanship as parts of the curriculum." This can be seen as a shift towards the ideology of education where physical education as a class is important not only for the physical aspect of a person but also as a means of molding the individual. Another insight provided by Participant 1, "Incorporating technology (e.g., virtual reality) can enhance alignment and engagement," suggests that using modern technologies to make it more interesting for students should be viewed as an opportunity to leverage current understanding of technology to improve the curriculum and make it more suitable for present-day students.

Theme 3: Teacher Professional Development.

Teacher training is informative and transformative to enable them to provide modern physical education. Professional development keeps educators knowledgeable on the contemporary teaching techniques to be applied in the classroom. Participant 3 stated, "Workshops, conferences, and online courses on improving teaching practices and embracing technology." This statement reveals the fact that education has not become static and that teachers require adequately updating themselves. Furthermore, Participant 4 also mentioned that "peer mentoring and school-

based training programs stated that knowledge sharing can be improved through peer mentoring and school-based training programs," evidencing the idea that professional development is a collective affair that improves the quality of physical education through sharing of experiences and ideas.

Theme 4: Student Engagement and Participation.

Accessibility is the basis for the success of any educational program, especially physical education, where students' involvement depends on interest. Every student will always find something of interest in the developed inclusive programs that are meant to accommodate all students. Participant 6 suggests, "It would be advisable to provide recreation clubs, sporting events, for instance, sporting festivals, nonrivalry games or sports, etc." This approach not only expands the range of activities offered to the students but also incorporates those with a diverse range of physical disabilities or preferences, making physical education more engaging. Two of the suggestions raised by Participant 5 included implementing "student-centered activities" and "incorporating student leadership opportunities." This statement reinforces students, offering them ownership in the development and implementation of the programs, making them more committed physically.

Theme 5: Technology Integration.

The integration of technology in teaching and content delivery presents new strategies for teaching and student engagement, individualization of peer tracking and monitoring, and improved responses to physical education students. The use of apps and virtual learning assistants facilitates teachers in utilizing modern technologies to offer innovative learning and teaching experiences. Participant 6 supported, "Fit-needy technology including fitness trackers and other fitness interactive platforms can be integrated into daily classes to track students' progress as well as involve them actively." This highlights how technology serves not only as a tool that tracks students' health indicators but also as a means to foster student engagement, as the chosen PE activities are made interactive. Moreover, Participant 3 stated, "Engagement in the use of ICT also entails the use of fitness trackers for measuring students' health and other applications for fitness programs." Incorporating technology into personal training allows PE classes to address each student's fitness requirements, including individual fitness goals, and makes fitness a noble pursuit for all students. Gamification combined with virtual reality increases the effectiveness of learning; therefore, teachers must be trained in these approaches regarding their most effective application in PE.

Theme 6: Safety and Wellness.

Proper safety and well-being are researched as basic concepts of physical education because they create a secure atmosphere for learners and also foster their general well-being, as education was defined above. Safety measures include cleanliness, compliance with norms, constant examination of the premises, and staff certification for emergencies. This priority was similarly echoed by Participant 8, "To ensure safety, it's crucial to have up-to-date equipment and facilities and to conduct regular safety audits." This aligns with the concept that solutions should be sought to curtail risks and ensure optimal safety levels for installations. Moreover, physical well-being is complemented by the promotion of mental health care. Participant 7 stated, "In the same way, well-being could also be enhanced by including a unit on mental health within the physical health unit." Through the implementation of Mental Health Days, which include exercises that promote stress reduction and encourage the setting aside of time for stress management sessions, students not only achieve physical health but also learn stress management skills. Altogether, these measures foster a comprehensive, safe, and holistic approach to the health and welfare of young people within Physical Education.

Theme 7: Assessment and Evaluation.

The importance of assessment and evaluation relates to the need to evaluate the impact and make necessary changes to the programs in physical education. Data collected in the form of formative assessments, questionnaires, and performance indicators are provided regularly, so that, based on the data, schools can modify the curriculum. Participant 10 emphasized the need for a complementary approach and added, "We should include not only students' perception of fun and their subjective satisfaction but also measure the fitness level enhancements." This two-pronged

approach guarantees that program delivery is engaging and functional and emphasizes the informational input of students as well as the physiological responses that actions trigger. Further, it was proposed by Participant 4, "To have performance indicators for students as well as program audit reviews, we should have a proper system to assess the effectiveness of programs." The structure that this approach provides allows schools to have rationally determined uniformity and equity in the use of assessment feedback for the proper development of the curriculum. These evaluations create conditions for effectiveness in that changes can be made to the format and delivery of the PE programs to reflect the needs of the students and align with national standards.

Delphi Method Round 1: Structured list of potential evaluation indicators Based on Thematic Analysis.

Table 3. List of potential evaluation indicators derived from thematic analysis.

Potential indicators	Information
Facility quality and accessibility	Availability and condition of sports facilities and equipment; accessibility for all students, including those with disabilities.
Curriculum relevance and diversity	Alignment with national educational standards; variety and inclusiveness of physical activities offered.
Professional development implementation	Frequency and quality of professional development programs; teacher satisfaction and practical application of training content.
Student engagement metrics	Participation rates in physical education classes and extracurricular activities; student feedback on the inclusiveness and enjoyment of PE programs.
Community involvement level	Number and quality of partnerships with local organizations; community engagement events and their impact on the program.
Technology utilization and effectiveness	Extent of technology integration in the curriculum; impact of technology on student engagement and learning outcomes.
Safety standards and health promotion	Compliance with safety protocols and regular safety audits; programs and initiatives focused on student wellness and mental health support.
Program evaluation and feedback	Effectiveness of physical education programs based on standardized assessments and feedback mechanisms; adjustments made to the program based on evaluation outcomes.

This Table 3 provides a clear, structured overview of the potential evaluation indicators with specific criteria to assess each aspect of the physical education program's modernization.

Delphi Method Round 2: Analysis of Structured Questionnaire.

In Delphi Round 2, the experts provided key points for improving the indicators used in the physical education modernization evaluation. To assess each indicator, a 5-point structured questionnaire was administered. Mean scores were computed for each indicator, which helped identify areas of strength and those requiring attention. High-scoring items included Facility Quality and Accessibility (92%) and Professional Development Implementation (90%), indicating that the experts regarded these areas as core components of a quality physical education program. Conversely, Student Engagement Metrics received a lower mean score of 52%, suggesting it may not be as critical in the current evaluation framework. Consequently, it was removed from the final indicator list, reflecting the experts' perspective on the parameters involved.

For the final round, the indicators have again been formulated based on more comments from the participants for the second round. Specifically, the Accessibility for All Students indicator was intended to be introduced to make required changes and allow stewardship for students with physical and cognitive impairments, according to participants' voices for equity. Another feature envisaged for introduction was Proximity to External Facilities to cater to wider sports requirements beyond school infrastructures. The participants also indicated the need for health-oriented partnerships, which translated into Healthcare Collaboration to harmonize with support from healthcare collaborations. Additionally, the Mental Wellness Checkpoints were to be integrated as part of physical education and mental health concerns. Thus, this step-by-step approach guarantees that the indicators developed now are more aligned with expert opinions and address numerous aspects of the modernization factors needed to evaluate and develop physical education in schools.

Table 4. Score presentation of participant's responses in survey questionnaire of round 2.

Indicator name	Information	Comments and suggestions	Average score (Out of 5)	Total % score
Facility quality and accessibility	Availability and condition of sports facilities and equipment.	Suggestion: Include accessibility for all students with physical and cognitive disabilities.	4.6	92%
	Accessibility for all students, including those with disabilities.	[Participant 1]: This indicator could also include proximity to external facilities to support wider access to sports.		
Curriculum relevance and diversity	Alignment with national educational standards.		4.2	84%
	Variety and inclusiveness of physical activities offered.	[Participant 3]: Additional focus on outdoor education as part of PE might expand inclusivity and engagement.		
Professional development implementation	Frequency and quality of professional development programs.		4.5	90%
	Teacher satisfaction and practical application of training content.	Suggestion: Adding a peer-to-peer training program could enhance knowledge sharing and skill development.		
Student engagement metrics	Participation rates in physical education classes and extracurricular activities.		2.6	52%
	Student feedback on the inclusiveness and enjoyment of PE programs.			
Community involvement level	Number and quality of partnerships with local organizations.		4.4	88%
	Community engagement events and their impact on the program.	[Participant 2]: Encourage partnerships with healthcare providers to promote physical and mental health in the community.		
Technology utilization and effectiveness	Extent of technology integration in the curriculum.		4.1	82%
	Impact of technology on student engagement and learning outcomes.	[Participant 6]: Additional focus on adaptive technology could make physical education more accessible to students with disabilities.		
Safety standards and health promotion	Compliance with safety protocols and regular safety audits.		4.2	84%
	Programs and initiatives focused on student wellness	Suggestion: Introduce a mental wellness checkpoint at the beginning of each PE		

Indicator name	Information	Comments and suggestions	Average score (Out of 5)	Total % score
	and mental health support.	class to support students' emotional needs.		
Program evaluation and feedback	Effectiveness of physical education programs based on standardized assessments and feedback mechanisms.		4.4	88%
	Adjustments made to the program based on evaluation outcomes.	[Participant 4]: Program feedback should include student, parent, and teacher perspectives for a more comprehensive approach.		

This Table 4 presents the average scores, percentage values, and expert suggestions for each indicator assessed in the Round 2 survey of the Delphi Method.

Delphi Method Round 3: Analysis of Final Questionnaire Containing Final Indicators for Evaluation Index.

Table 5. Score presentation of participants' responses in survey questionnaire of round 3.

Indicator name	Information	Average score (Out of 5)	Total % score
Facility quality	Availability and condition of sports facilities and equipment.	4.4	88%
Accessibility	Accessibility of facilities for students with physical and cognitive disabilities.	4.8	96%
	Access to external facilities for additional sports opportunities.		
Curriculum relevance and diversity	Alignment with national educational standards.	4.7	94%
	Variety and inclusiveness of physical activities offered.		
Variety in physical activities	Inclusion of diverse and inclusive physical activities.	4.2	84%
Professional development implementation	Frequency and quality of professional development programs.	4.1	82%
	Teacher satisfaction and practical application of training content.		
	Student feedback on the inclusiveness and enjoyment of PE programs.		
Community involvement level	Number and quality of partnerships with local organizations.	4.2	84%
	Community engagement events and their impact on the program.		
Healthcare collaboration	Partnerships with healthcare providers to promote physical and mental health.	4.3	86%
Technology utilization and effectiveness	Extent of technology integration in the curriculum.	4.4	88%
	Impact of technology on student engagement and learning outcomes.		
Safety standards and health promotion	Compliance with safety protocols and regular safety audits.	4.3	86%
	Programs and initiatives focused on student wellness and mental health support.		
Mental wellness checkpoints	Implementation of mental wellness checkpoints at the start of physical education classes.	4.7	94%
Program evaluation and feedback	Effectiveness of physical education programs based on standardized assessments and feedback mechanisms.	4.8	96%
	Adjustments made to the program based on evaluation outcomes.		

Table 5 presents the average scores and total percentage values for each indicator based on participant responses in Round 3 of the survey. This assessment of the Delphi Method Round 3 indicators presupposes the synthesis of experts' perspectives on the different aspects of physical education modernization. Accessibility, which is 96%, revealed that facilities need to be made more accessible to accommodate students with disabilities, while Program Evaluation and Feedback, also at 96%, showed that the program should be continuously evaluated for its effectiveness. Mental Wellness Checkpoints (94%) and Curriculum Relevance (94%) were also very high, highlighting the significance of mental health support and the relevance of curricula to national standards.

Notably, three new indicators have been added in this round, including Variety in Physical Activities (84%), Healthcare Collaboration (86%), and Mental Wellness Checkpoints (94%), indicating an increased emphasis on diversity, health, and student welfare. These additions were in regard to the suggestions that the concerned experts made during the earlier rounds of review. However, percentages for Professional Development (82%) are slightly lower but still noteworthy, which indicates that increased efficiency of PE modernization could be attained with additional development of teacher training programs. Based on the data presented in this paper, it is important to note that such a framework should incorporate several elements that can and should enhance physical education as a curricular subject in the twenty-first century.

Table 6. Weight factor judgment table.

Order number	Evaluating indicator	Evaluation index		Score value [Scores are calculated out of 5] (Summation of scores given by experts)	Average score	Total sum of average scores	Weight calculation
		Metric 1	Metric 2				
1	Facility quality	Facility condition	-	44	4.4	4.4 + 4.8 + 4.7 + 4.2 + 4.1 + 4.2 + 4.3 + 4.4 + 4.3 + 4.7 + 4.8 = 48.9	4.4 / 48.9 ≈ 0.090
2	Accessibility	Disability access	External facility access	48	4.8		4.8 / 48.9 ≈ 0.098
3	Curriculum relevance	National educational standards alignment	Activity diversity	47	4.7		4.7 / 48.9 ≈ 0.096
4	Physical activities variety	Diverse and inclusive physical activities	-	42	4.2		4.2 / 48.9 ≈ 0.086
5	Professional development	Training frequency	Teacher satisfaction	41	4.1		4.1 / 48.9 ≈ 0.084
6	Community involvement	Partnerships quality	Engagement events	42	4.2		4.2 / 48.9 ≈ 0.086
7	Healthcare collaboration	Health partnerships	-	43	4.3		4.3 / 48.9 ≈ 0.088
8	Technology utilization	Tech integration	Student engagement	44	4.4		4.4 / 48.9 ≈ 0.090
9	Safety standards	Protocol compliance	Wellness programs	43	4.3		4.3 / 48.9 ≈ 0.088
10	Wellness checkpoints	Mental health checkpoints	-	47	4.7		4.7 / 48.9 ≈ 0.096
11	Program evaluation	Assessment effectiveness	Program adjustments	48	4.8		4.8 / 48.9 ≈ 0.098

Table 6 presents the weight factor judgment of evaluation indicators and emphasizes their relative importance in the modernization of physical education programs. The weight factor judgment method produces the last evaluation index to emphasize the significance of these indicators concerning the modernization of physical education. Two criteria, Accessibility and Program Evaluation, have the highest weights of 0.098, indicating their importance in ensuring supply accessibility and the continuous evaluation of programs. Curriculum Relevance and Wellness Checkpoints are closely related, with weights of 0.096, suggesting that curriculum standards should be relevant throughout the process, and students' well-being should be monitored. Facility Quality and Technology Utilization factors have relatively large coefficients (0.090), highlighting the importance of well-maintained, accessible facilities and the integration of technology in physical education. Less critical but still important quality indicators include Professional Development (0.084) and Physical Activities Variety (0.086); improvements in these areas could further benefit the PE program, although they are less prioritized than other factors. The more or less equal distribution of weights ensures that each indicator receives adequate attention, providing a comprehensive overview of a modern physical education system that addresses multiple aspects simultaneously. The following is a weighted matrix of criteria that offers a framework for prioritizing initiatives and resources for designing and evaluating physical education programs in schools.

5. DISCUSSION

5.1. Identification of Key Indicators for Physical Education Modernization

This study provides an extensive array of essential factors for assessing the modernization of PE programs in high schools in Nanchong. From the identified themes, such as infrastructure and facilities, relevance and access, teacher learning, students' interests and motivation, technology, safety and health, and outcome and evaluation, the research question is closely matched. This alignment demonstrates the complexity of the concept of modernization in evaluating PE and supports the idea that evaluation must include multiple domains of learning experience. It is corroborated by similar research concerning the possibilities of evaluating the modernization of PE from different primary indicators. For example, Lobo et al. (2023) explain that students' continuous interactions in PE depend on the perceived relevancy and fun of the curriculum. This aligns with the current study, where curriculum design focuses on activities that support development. The notion that enjoyment and physical activity are major elements influencing PE outcomes is supported by the literature, which claims that when students are interested in the material, they show increased interest, resulting in changes in attitudes and levels of participation (Lobo et al., 2023). Additionally, there is consistency with the research of Kemeryte-Ivanauskiene, Brandisauskiene, Cesnaviciene, and Daugirdiene (2022), focusing on the idea that mandatory school PE is a necessity for improving engagement in physical activities among youths. Their instance suggests that a well-organized PE program can facilitate physical inactivity among adolescents and underlines the importance of revising curricula to fit the contemporary audience. This calls for the development of programs that will at least meet the existing set standards and, at the same time, enable students to understand personal appeals.

Teacher professional development, as described by this study, has also been highlighted in prior literature. Chen and Wang (2017) state that the attitude and motivation of the teachers create a major boost to the engagement of the students in PE. In this view, the current study's conclusion emphasizing the need for professional development of teachers and their mentorship tally with this requirement, as the purpose of training teachers to use innovative approaches to teaching is crucial for creating a stimulating learning environment. Furthermore, as established in the preceding findings, the adoption of technology in PE programs is considered a crucial part of modernization. Integrating technology into the classroom and performance-tracking devices can make assignments interesting as well as relevant to individual learners. This concurs with Zhang and Qian (2022) argument that engagement can be enhanced by autonomy-supportive, technology-based teaching strategies regardless of students' abilities. However, the study also identifies areas that require improvement based on the low average score given in student engagement

parameters. This indicates that, even though infrastructure and curriculum received prominence, the use of students in PE activities continues to be a problem. Similar to these findings, Gairns, Whipp, and Jackson (2015) concluded that adolescent physical activity preferences favored sedentary behaviors, and despite the knowledge of the benefits of recommended physical activity, adolescent participation levels remain below this range. This suggests a role for new approaches toward increased student engagement with PE, which means that the programs developed must be not only available but also interesting to a broad audience. Thus, the completion of this study helps enrich the database of information regarding the modernization of PE by determining the significant aspects that define a set of indicators covering different aspects of education. Based on these indicators, we are able to assess and enhance PE in Nanchong schools and bring positive change that will meet the students' demand and need for physical activity.

5.2. Developing a Weighting System for Modernization Evaluation Indicators

The results of this study present concrete promotive and restrictive factors for constructing a synthetic indicator system for the modernization evaluation of high school PE programs in Nanchong. It is evident that the high consensus among experts regarding the relevance of indicators such as Accessibility, Program Evaluation and Feedback, and Curriculum Relevance supports the research question. It also highlights the need for a systematic approach to the assessment of modernization in PE, specifically, ensuring that such modernization is developmental, progressive, inclusive, and aligned with the National Curriculum Framework of education. These results are further justified by similar studies, such as those touching on the importance of accessibility in the learning environment. For example, Paccoud et al. (2021) argue that socioeconomic factors define the level of access to educational resources and point to the higher vulnerability of students originating from backgrounds of social inequality resulting from limitations to perform physical activities. This is in line with the current study, which seeks to establish the measures that need to be taken to make facilities most accessible to students with physical and cognitive challenges. It has been concluded that overcoming these barriers might play an important role in creating conditions for the inclusion of all students. Further, the focus on Program Evaluation and Feedback correlates with the works of D'Agostino, Urtel, Webster, McMullen, and Culp (2021), who pointed out that the continuation of assessment is crucial for making effective modifications to the educational programs for students. They state that failure to review program processes can cause learning interventions to not evolve to meet new challenges and opportunities. This view supports the current study's conclusions on integrating feedback loops to improve the relevance and effectiveness of the PE programs.

The study also establishes Curriculum Relevance and Diversity as significant contributors to fulfilling expectations, as supported by the literature. Jenkinson and Benson (2010) examine how institutionalization can pose challenges to the effectiveness of PE programs. They stress that curricula must be flexible and sensitive to address the diverse contexts of students. This aligns with current research emphasizing the need to adapt PE curricula to meet national standards and include a variety of activities to consider children's interests and abilities. Furthermore, the findings related to Professional Development Implementation indicate that greater attention should be given to developing teacher training programs. Sladewski, Lieberman, Haibach-Beach, and Conroy (2022) opined that teachers are doubtful about their knowledge of how to modify PE for children with disabilities, thus discouraging the professional preparation required in teaching. This implies that funding robust and extensive professional development is critical in preparing educators to deliver highly transformed PE programs. In addition, new indicators of student welfare suggested and introduced, namely Healthcare Collaboration and Mental Wellness Checkpoints, highlight a shift in understanding of the welfare issues important in physical education programs. Therefore, the work contributes valuable insight to the assessment of the indicators for evaluating the modernization of PE programs.

6. CONCLUSION

6.1. Key Findings

The conclusions from this study emphasize the comprehensive construction of the modernization evaluation index of physical education in Nanchong High Schools, highlighting several important points. Firstly, the roles and emphasis on the facilities discussed by the analysis show the importance of having quality and accessible infrastructures and complexes that can meet the needs of diverse students. This also involves the use of technology to ensure full student engagement through the environments created, as well as to optimize learning outcomes. Moreover, the significance of the curriculum in relation to national standards for students and the diversity of the curriculum to cater to students' interests and needs was established. Regarding the curricula, it was pointed out that curricula with a wide variety of activities are effective in fostering physically educated learners and ensuring meaningful student participation. It was also noted that professional development for educators is of critical importance. Professional development, along with furniture, equipment, teaching aids, educational forums, learning models, and methods accessibility, are regarded as essential for teachers to deliver and adapt physical education curricula or programs effectively. The involvement of the community and collaboration with other organizations were also identified as factors that complement physical education classes and extend resources and student activities. Safety and wellness, especially the inclusion of mental health in physical education, are considered fundamental to achieving an all-round educational delivery. Furthermore, adopting a scientific approach to the actualization and continuous reassessment of these indicators, based on professional consensus, guarantees that the evaluative index remains objective and aligned with the educational objectives of physical education modernization in the region. Therefore, these findings provide a rationale for targeted enhancements and strategic adjustments in the modernization of physical education.

6.2. Limitation of Research

The major limitation of this study is based on the use of the Delphi method to gather information, as well as the restricted sample size and locality of the participants drawn from the Nanchong High School System. It must be noted that, although useful for gathering consensus among experts through the Delphi method, the results and the developed modernization evaluation index might not necessarily capture other potentially more diverse and geographically distributed expert opinions that could emerge in the process. Moreover, the emphasis on a particular area of study excludes the possibility of using the results obtained for other situations that may be faced in the process of modernizing physical education. Due to the cross-sectional approach employed in the study, the characteristics of the study design limit the assessment of temporal changes, and therefore, new changes or trends, as well as the cumulative effects of the already implemented modernization strategies, can easily be overlooked. Finally, the outcomes of the study are greatly influenced by the opinions of the chosen specialists, and, therefore, potential bias due to personal predilections or professional orientations that were disclosed within the framework of the highly methodological approach used in the present research. Such subjectivity could impact the observability and replicability of the evaluation index in different educational contexts or across diverse cultures.

6.3. Future Recommendation

In light of the shortcomings assessed in the present research study, they suggest further research should incorporate a wider geographic sample as well as include a diverse group of experts from many regions and education systems. This would generalize the results and would guarantee the modernization evaluation index suitable for different physical education settings. Longitudinal studies are also recommended for showing change over time and the effects of change in modernization processes and the effects of various modernization strategies. Furthermore, the use of quantitative data in this study will enrich the qualitative outcomes of the Delphi method by incorporating more objective findings for associated overarching expert-related assessments. Future research could also examine the

feasibility of leveraging other technologies to enable live data capturing and decision-making regarding the modernization processes for practicing organizations. Moreover, inviting stakeholders from public health and urban planning may provide a broader perspective on the factors affecting physical education modernization and improve interdisciplinary approaches to addressing systemic societal and environmental challenges to educational qualifications.

Funding: This study received no specific financial support.
Institutional Review Board Statement: The Ethical Committee of the Xihua Normal University, China has granted approval for this study on 21 March 2024 (CWNU-2024-018).
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

REFERENCES

Brannagan, P. M., & Grix, J. (2023). Nation-state strategies for human capital development: The case of sports mega-events in Qatar. *Third World Quarterly*, *44*(8), 1807–1824. https://doi.org/10.1080/01436597.2023.2200159

Bungum, B., Bøe, M. V., & Henriksen, E. K. (2018). Quantum talk: How small-group discussions may enhance students' understanding in quantum physics. *Science Education*, *102*(4), 856-877. https://doi.org/10.1002/sce.21447

Chen, A., & Wang, Y. (2017). The role of interest in physical education: A review of research evidence. *Journal of Teaching in Physical Education*, *36*(3), 313-322. https://doi.org/10.1123/jtpe.2017-0033

D'Agostino, E. M., Urtel, M., Webster, C. A., McMullen, J., & Culp, B. (2021). Virtual physical education during COVID-19: Exploring future directions for equitable online learning tools. *Frontiers in Sports and Active Living*, *3*, 716566. https://doi.org/10.3389/fspor.2021.716566

Gairns, F., Whipp, P. R., & Jackson, B. (2015). Relational perceptions in high school physical education: Teacher-and peer-related predictors of female students' motivation, behavioral engagement, and social anxiety. *Frontiers in Psychology*, *6*, 850. https://doi.org/10.3389/fpsyg.2015.00850

Griggs, G., & Fleet, M. (2021). Most people hate physical education and most drop out of physical activity: In search of credible curriculum alternatives. *Education Sciences*, *11*(11), 701. https://doi.org/10.3390/educsci11110701

Hall-López, J. A. (2021). Resistance to change in higher education institutions: Factors and strategies. *International Journal of Educational Management*, *35*(2), 393–406.

Jajang, J., Purwanto, S., Nanda, F. A., & Novriansyah, N. (2021). Management of facilities and infrastructure of physical education in state junior high school. *Journal of Education Research and Evaluation*, *5*(2), 258–264. https://doi.org/10.23887/jere.v5i2.33683

Jenkinson, K. A., & Benson, A. C. (2010). Barriers to providing physical education and physical activity in Victorian state secondary schools. *Australian Journal of Teacher Education*, *35*(8), 1–17. https://doi.org/10.14221/ajte.2010v35n8.1

Kemeryte-Ivanauskiene, E., Brandisauskiene, A., Cesnaviciene, J., & Daugirdiene, A. (2022). The significance of students' physical activity for their engagement in learning activities during the COVID-19 pandemic. *Physical Education Theory and Methodology*, *22*(4), 522–529. https://doi.org/10.17309/tmfv.2022.4.10

Kersting, M., Schrocker, G., & Papantoniou, S. (2021). 'I loved exploring a new dimension of reality'–a case study of middle-school girls encountering Einsteinian physics in the classroom. *International Journal of Science Education*, *43*(12), 2044-2064. https://doi.org/10.1080/09500693.2021.1950943

Li, W., & Hu, T. (2023). Research on the construction of index system to promote the sustainable development of core literacy of physical education teachers in Chinese universities from the perspective of higher education modernization. *Sustainability*, *15*(18), 13921. https://doi.org/10.3390/su151813921

Lindsay, W. E., & Otero, V. K. (2023). Leveraging purposes and values to motivate and negotiate reform. *Science Education*, *107*(6), 1531-1560. https://doi.org/10.1002/sce.21815

Lobo, J., Martin, J., Argarin, J., Tubera, J., Narciso, H. A., & Dimalanta, G. (2023). Physical culture for lifelong healthy participation: Expanding the horizon of individual interest and university engagement in physical education in higher education. *Masyarakat, Kebudayaan dan Politik*, *36*(3), 342–355. https://doi.org/10.20473/mkp.v36i32023.342-355

Nova, A., Syahputra, M., Roberto, J., Surimeirian, M. A., & Nofrizal, D. (2023). Management policy for standardization of physical education learning infrastructure at the elementary school level in Langsa City, Indonesia. *Indonesian Journal of Sport Management*, *3*(2), 198–207. https://doi.org/10.31949/ijsm.v3i2.6982

Paccoud, I., Baumann, M., Le Bihan, E., Pétré, B., Breinbauer, M., Böhme, P., … Leist, A. K. (2021). Socioeconomic and behavioural factors associated with access to and use of personal health records. *BMC Medical Informatics and Decision Making*, *21*(1), 18. https://doi.org/10.1186/s12911-020-01383-9

Parker, C., Scott, S., & Geddes, A. (2019). *Snowball sampling. SAGE Research Methods Foundations.* Retrieved from https://eprints.glos.ac.uk/id/eprint/6781

Piñeiro-Cossio, J., Fernández-Martínez, A., Nuviala, A., & Pérez-Ordás, R. (2021). Psychological wellbeing in physical education and school sports: A systematic review. *International Journal of Environmental Research and Public Health*, *18*(3), 864. https://doi.org/10.3390/ijerph18030864

Shirotriya, A. K., Dixit, S., & Jaiswal, R. (2024). Physical education: A catalyst for transforming public health systems in schools. *Sports Science & Health Advances*, *2*(2), 275-280. https://doi.org/10.60081/SSHA.2.2.2024.275-280

Sladewski, J., Lieberman, L. J., Haibach-Beach, P., & Conroy, P. (2022). Professional preparation of teachers of students with visual impairments and orientation and mobility specialists regarding physical activity, physical education, and sport. *Journal of Visual Impairment & Blindness*, *116*(2), 240-251. https://doi.org/10.1177/0145482X221090526

Wu, Q., Wu, J., & Li, Y. (2021). Toward a smart learning environment: A comprehensive framework for promoting learning performance through technology integration and learning climate. *Educational Technology Research and Development*, *69*(1), 279–301.

Xiaofei, W., Korobeinik, V. A., & Kozina, Z. L. (2021). Features of the organization of teaching for future physical education teachers in the People's Republic of China and the possibility of implementing an individual approach in their training: A review article. *Health, Sport, Rehabilitation*, *7*(2), 8-17.

Yao, J. (2023). Development and application of modern educational technology in physical education: Trends, challenges and recommendations. *International Journal of Education and Humanities*, *10*(3), 129–133.

Yu, Z., Xing, Y., & Liu, H. (2024). The establishment and quality improvement effect of physical education teaching evaluation system in higher education institution. *Applied Mathematics and Nonlinear Sciences*, *9*(1), 1-17. https://doi.org/10.2478/amns-2024-1149

Zhang, B. G., & Qian, X. F. (2022). Weight self-stigma and engagement among obese students in a physical education class. *Frontiers in Psychology*, *13*, 1035827. https://doi.org/10.3389/fpsyg.2022.1035827

Zhao, C., & Gudamu, A. (2021). Ranking of teaching evaluation index system of public physical education curriculum based on management by objectives using analytic hierarchy process. *Mobile Information Systems*, *2021*(1), 2729574. https://doi.org/10.1155/2021/2729574

Zhu, Y. (2019). New national initiatives of modernizing education in China. *ECNU Review of Education*, *2*(3), 353-362. https://doi.org/10.1177/2096531119868069