

Article

Research on the Innovative Paths of Integration between Physical Education Courses and Ethnic Minority Traditional Sports in Higher Vocational Colleges of Yunnan

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Abstract: The integration of physical education (PE) curricula with ethnic minority traditional sports (EMTS) in higher vocational colleges in Yunnan is crucial for inheriting ethnic culture and enriching vocational education content. Currently, challenges such as monotonous curriculum content, insufficient teacher competence, and inadequate resource allocation persist, with a lack of empirical research targeting higher vocational education. Based on Ralph W. Tyler's curriculum development theory and Mishra and Koehler's TPACK framework, this study explores the impacts of curriculum content integration methods, teachers' competence, and resource allocation on integration implementation effectiveness. A quantitative analysis was conducted using questionnaire surveys from 104 PE teachers across five higher vocational colleges in Yunnan Province. The results show that diversified curriculum integration, improved teacher competence, and effective resource allocation all exert significant positive effects on integration implementation effectiveness. These findings provide empirical evidence for the development of culturally responsive physical education programs in vocational settings. Accordingly, it is recommended to optimize curriculum module design, strengthen teacher training programs, and improve college-local collaborative guarantee mechanisms to promote deeper integration and sustainable development of ethnic minority traditional sports within higher vocational education systems.

Keywords: physical education; ethnic minority sports; curriculum integration; teacher competence; vocational education

1. Introduction

The integration of physical education (PE) courses with ethnic minority traditional sports (EMTS) represents an important pathway for preserving ethnic culture and enriching vocational education content [1]. Ethnic minority traditional sports carry profound historical and cultural connotations, serving not only as recreational or competitive activities but also as cultural practices embedded in specific landscapes and historical contexts. In Yunnan Province, a multi-ethnic region with the largest number of ethnic minority components in China, these traditional sports contain rich cultural value and educational potential. The Yunnan Provincial Sports Bureau's 14th Five-Year Plan clearly proposes to develop ethnic sports. Integrating EMTS into PE courses in higher vocational colleges responds to national policies of sports-education integration and traditional cultural inheritance, while also enhancing students' cultural identity and learning engagement.

However, current integration practices in Yunnan higher vocational colleges face multiple dilemmas. Numerous studies indicate that monotonous curriculum content, insufficient teachers' competence, and lagging resource allocation have seriously restricted integration implementation effectiveness. Monotonous curriculum content and rigid assessment methods reduce students' learning interest, accompanied by boredom and cultural alienation, which weaken students' cognition and identification with ethnic

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culture. Inadequate professional teachers' competence and low teaching confidence further lead to declining teaching quality and negative teaching attitudes [2]. In addition, shortages of venues, equipment, and funding increase teaching difficulties and restrict the development of distinctive courses. Problems such as insufficient curriculum attractiveness, teacher burnout, and low student engagement not only increase the burden of teaching management but also pose greater challenges to the living inheritance of traditional ethnic sports.

According to previous studies, various factors affecting integration implementation effectiveness have been identified, including curriculum policy support, school leadership attention, student motivation, and evaluation systems [1]. Nevertheless, this study focuses on three core independent variables: curriculum content integration methods, teachers' competence, and resource allocation. These variables cover comprehensive influences at the curriculum design, human, and material levels, taking into account the organizational form of the teaching process, teachers' core competence, and supporting conditions for instruction.

In the field of curriculum and teaching theory, curriculum content integration methods exert a decisive influence on integration implementation effectiveness. Ralph W. Tyler's curriculum development theory emphasizes that systematic design of curriculum objectives, content selection, organization, and evaluation directly determines curriculum implementation outcomes [3]. A diversified and integrated curriculum model can effectively stimulate students' learning interest and enhance cultural identity, whereas a monotonous and rigid model results in low student engagement and weak cognition.

Teachers' competence in PE significantly affects integration implementation effectiveness and constitutes the core human element determining integration quality [4]. The TPACK (Technological Pedagogical Content Knowledge) framework states that teachers must integrate content knowledge, pedagogical knowledge, and technological knowledge. Teachers with high comprehensive competence can proficiently apply diverse teaching methods, understand the connotation of ethnic culture, and organize teaching activities effectively, thereby significantly improving integration implementation effectiveness. Conversely, insufficient professional competence among teachers forms a critical bottleneck.

Resource allocation serves as the material foundation supporting integration practice [5]. Sufficient venues, equipment, special funding, and digital teaching resources effectively guarantee the regular implementation of teaching activities and thereby improve integration implementation effectiveness; resource scarcity severely restricts the standardization and sustainability of teaching. Rational venue planning, guaranteed funding, and standardized teaching resource development are considered important external conditions for enhancing integration outcomes.

There is limited research available pertaining to the unique situation and characteristics of higher vocational colleges in ethnic regions. Existing studies mostly focus on basic education or ordinary universities, with a clear lack of systematic theoretical discussion and empirical examination targeting the characteristics of higher vocational education as a type of education. The higher vocational education sector in Yunnan faces distinctive challenges, including a shortage of professional teachers (less than 3% of researchers specialize in EMTS), incomplete teaching material systems, and insufficient school-local collaboration mechanisms [6]. Moreover, while the integration of EMTS into school PE has been discussed in policy documents, empirical research on the specific influencing factors and their action paths in higher vocational colleges remains scarce.

Based on the analysis presented above, the researcher believes it is necessary to empirically test the impacts of curriculum content integration methods, teachers' competence, and resource allocation on integration implementation effectiveness in Yunnan higher vocational colleges. This study adopts a quantitative research design, collecting data from PE teachers in five representative higher vocational colleges in Yunnan Province. The purpose of this study is to identify the relationships between the

three independent variables (curriculum content integration methods, teachers' competence, and resource allocation) and the dependent variable (integration implementation effectiveness), so as to provide theoretical support and practical guidance for optimizing the integration path [7].

The significance of this study is twofold. Theoretically, by integrating Tyler's curriculum development theory and the TPACK framework, it provides a new analytical perspective for understanding the integration mechanism between PE curricula and cultural inheritance in higher vocational education, filling the research gap in higher vocational contexts [8]. Practically, the findings offer feasible intervention strategies for school administrators and policymakers, including optimizing curriculum module design, strengthening teacher training, and improving college-local collaborative guarantee mechanisms, to promote the in-depth integration of EMTS into PE courses in Yunnan higher vocational colleges.

2. Literature Review

2.1. Overview

This chapter reviews the research context of integrating ethnic minority traditional sports (EMTS) into school physical education from global and Chinese perspectives. It then discusses the three core independent variables—curriculum content integration methods, teachers' competence, and resource allocation—and their relationships with integration implementation effectiveness. Based on the theoretical foundations of curriculum development theory and the TPACK framework, this chapter develops the conceptual framework and formulates the research hypotheses [6].

2.2. Underlying Theories

This study is grounded in two complementary theoretical frameworks: Tyler's curriculum development theory and the TPACK framework.

Ralph W. Tyler proposed the Tyler Rationale, a foundational model for curriculum development that emphasizes the systematic design of curriculum objectives, content selection, organization, and evaluation. Tyler argued that effective curriculum development must begin with clearly defined objectives derived from three sources: the learners, contemporary society, and subject matter specialists [9]. These objectives then guide the selection of learning experiences, the organization of these experiences, and the evaluation of whether objectives have been achieved. In the context of integrating EMTS into PE courses, Tyler's theory suggests that curriculum content integration methods should be goal-oriented and systematically structured to ensure that students not only acquire sports skills but also develop cultural identity and learning engagement.

The TPACK framework extends Shulman's concept of pedagogical content knowledge by integrating technological knowledge [10]. TPACK consists of three core components: content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK), as well as their intersections (PCK, TCK, TPK, and TPACK). The framework emphasizes that effective teaching with technology requires teachers to understand how to represent concepts using technology, employ pedagogical techniques that use technology in constructive ways, and navigate the complex interplay among content, pedagogy, and technology. In the context of teaching EMTS, teachers' competence (the second independent variable) refers to their ability to integrate ethnic cultural content knowledge (e.g., history, rules, skills of traditional sports), pedagogical knowledge (e.g., contextual teaching strategies, cultural cognition methods), and technological knowledge (e.g., multimedia resources, digital teaching platforms). Teachers with high TPACK can more effectively implement EMTS teaching and thereby improve integration implementation effectiveness.

Together, Tyler's theory provides a macro-level framework for curriculum design, while TPACK offers a micro-level framework for teacher competence. Resource allocation is positioned as the material support system that enables the implementation of both curriculum design and teacher competence [4]. This integrated multi-theoretical approach

allows for a more comprehensive analysis of the factors influencing integration implementation effectiveness in higher vocational colleges.

2.3. Relations between Curriculum Content Integration Methods and Integration Implementation Effectiveness

Curriculum content integration methods refer to the specific strategies, approaches, and organizational forms adopted to incorporate EMTS programs into the PE curriculum system of higher vocational colleges, including program selection, module design, teaching implementation, and evaluation innovation [11]. Tyler's curriculum development theory emphasizes that systematic design of curriculum objectives, content selection, organization, and evaluation directly determines curriculum implementation outcomes.

Studies have shown that diversified and systematic curriculum content integration methods can effectively enhance integration implementation effectiveness. Xu emphasized the need to build a "culture-skill-practice" trinity teaching module, strengthening cultural cognition through documentaries, storytelling, and festival rituals, then teaching technical movements in stages, and finally organizing social practice to complete the transformation from classroom to daily life. This experiential learning model increased students' cultural cognition satisfaction to 85%. Bai further noted that the integrated development concept of "teaching, training, competition and research" should be fully integrated into classroom teaching. Schools adopting diversified integration models generally develop curricula with local ethnic characteristics, thereby effectively improving students' participation and cultural identity [12].

However, current curriculum offering in Yunnan higher vocational colleges remains problematic [1]. Ran and Tong found that martial arts programs such as Wushu and Tai Chi are offered in nearly 100% of universities, while other EMTS programs are severely limited. This monotony leads to low student engagement and weak cultural cognition. Based on the above analysis, the first hypothesis is proposed:

H1: Curriculum content integration methods have a significant positive impact on integration implementation effectiveness [6].

2.4. Relations between Teachers' Competence and Integration Implementation Effectiveness

Teachers' competence in this study specifically refers to the comprehensive knowledge and ability structure required for PE teachers to effectively implement EMTS teaching. Based on the TPACK framework, this competence includes not only sports skills and teaching methods but also the understanding of ethnic culture, the application of relevant teaching technologies, and the ability to integrate these three dimensions [13].

The relationship between teachers' competence and integration implementation effectiveness has been widely recognized. Current PE teacher training mainly focuses on modern sports programs, lacking systematic mastery of EMTS programs. Teachers have insufficient understanding of traditional culture and theoretical reserves, failing to fully tap the resource value of excellent traditional culture in PE courses [7]. It was reported that only some PE teachers in Gansu Province have received training in EMTS teaching, resulting in many schools facing the dilemma of "having programs but no teachers"—a situation also prominent in Yunnan higher vocational colleges.

Conversely, teachers with high comprehensive competence can proficiently apply diverse teaching methods, understand the connotation of ethnic culture, and organize teaching activities effectively, thereby significantly improving integration implementation effectiveness [5]. Proposals have been made to cultivate "versatile" compound teachers who master both modern PE teaching ability and professional theories in EMTS. A "theory + practice" training model has been suggested, including learning the history and techniques of EMTS and field visits to observe folk inheritors. Based on the above analysis, the second hypothesis is proposed:

H2: Teachers' competence has a significant positive impact on integration implementation effectiveness [14].

2.5. Relations between Resource Allocation and Integration Implementation Effectiveness

Resource allocation refers to the material and organizational conditions required to support the smooth development of EMTS teaching, mainly including special venues and equipment, special fund investment, teaching materials or digital teaching resources, and internal and external collaborative guarantee mechanisms. As the material foundation supporting integration practice, resource allocation directly affects whether teaching activities can be implemented regularly and sustainably [15].

Studies have verified that adequate resource allocation significantly enhances integration implementation effectiveness. Some EMTS bases in Yunnan universities are equipped with special venues and facilities, but some programs still use shared venues, creating challenges in venue use allocation. Affected by regional location and the level of economic and social development, higher vocational colleges are short of venues and equipment, which restricts the extensive development of EMTS programs. Insufficient fund investment is another important bottleneck. Under market economy conditions, schools have the characteristics of high social benefits but low own benefits, and the main funds come from government appropriations.

The lag in teaching material construction further affects the standardization of curriculum implementation. Yunnan Province has not published systematic teaching materials for EMTS, resulting in a lack of unified and standardized basis for teaching. Developing a provincial standardized teaching video database has been suggested to provide standardized teaching resources. In response to these dilemmas, systematic optimization suggestions have been proposed, including rational venue planning, proper fund usage, and establishing school-local collaborative mechanisms. Based on the above analysis, the third hypothesis is proposed:

H3: Resource allocation has a significant positive impact on integration implementation effectiveness [16].

2.6. Conceptual Framework and Hypotheses

Based on curriculum development theory and the TPACK framework, this study proposes a conceptual framework in which curriculum content integration methods, teachers' competence, and resource allocation are hypothesized to have significant positive effects on integration implementation effectiveness. The framework positions curriculum content integration methods as the curriculum design factor, teachers' competence as the human factor, and resource allocation as the material support factor, all jointly influencing the dependent variable.

Curriculum content integration methods have a significant positive impact on integration implementation effectiveness.

Teachers' competence has a significant positive impact on integration implementation effectiveness [17].

Resource allocation has a significant positive impact on integration implementation effectiveness.

3. Methods

3.1. Population and Sample

The target population of this study was physical education (PE) teachers in higher vocational colleges in Yunnan Province, China [3]. Specifically, the study focused on PE teachers from five representative higher vocational colleges, including Kunming Metallurgy College, Yunnan Communications Vocational and Technical College, Yunnan Business Vocational College, and two other institutions. These colleges were selected because they represent a range of institution types (science and engineering, comprehensive, and vocational) and have actively explored the integration of ethnic minority traditional sports into their PE curricula.

Owing to time and resource constraints, cluster sampling was adopted. Cluster sampling involves dividing the overall population into groups, taking the entire cluster as the sampling unit, randomly selecting a number of clusters, and investigating all

individuals within the selected clusters. All PE teachers from the five selected colleges were invited to participate, ensuring complete raw data and reducing sampling errors.

The sample size was estimated a priori using G*Power 3.1.9.7. Given a statistical power of 0.80, a significance level (α) of 0.05, a medium effect size (f^2) of 0.15, and three predictors (curriculum content integration methods, teachers' competence, and resource allocation), the minimum required sample size was calculated to be 77. To increase statistical power, improve precision, and account for potential non-response or incomplete data, a larger sample of 110 PE teachers was targeted.

3.2. Data Collection Procedure

The questionnaire was designed using the "Questionnaire Star" platform and distributed in July 2022 via online links through WeChat work groups. The survey remained open for approximately two weeks. Each respondent was asked to complete the questionnaire only once, with an estimated completion time of 15 minutes [6]. Participation was voluntary, and all respondents were informed of the research purpose prior to the survey. They could freely choose to withdraw at any time, ensuring ethical compliance and data authenticity.

A total of 110 questionnaires were distributed [12]. After excluding incomplete or invalid responses, 104 complete and valid questionnaires were received, yielding a response rate of 94.54%. This sample size exceeded the minimum requirement calculated by G*Power, indicating adequate statistical power for subsequent analyses.

Demographic Characteristics: The demographic profile of the respondents included gender, age, education level, and professional title [7, 8]. Table 1 presents the demographic characteristics of the 104 participants.

Table 1. Demographic information about respondents (N = 104).

Item	option	Frequency(n)	Percentage (%)
Gender	Male	55	53%
	Female	49	47%
Age	20-24	0	0%
	25-29	13	13%
	30-34	32	31%
	35-39	34	33%
	≥ 40	25	24%
Education Level	Doctoral degree	25	24%
	Master degree	77	74%
	Undergraduate degree	2	2%
	Diploma	0	0%
Professional Title	No Professional Title	6	6%
	Junior	18	17%
	Intermediate	54	52%
	Associate Senior	19	18%
	Full Senior	7	7%

The gender distribution was relatively balanced, with males accounting for 53% (n = 55) and females 47% (n = 49). In terms of age, the majority of respondents were aged 30–39 (63%), indicating that the sample was primarily composed of young and middle-aged teachers. Regarding education level, master's degree holders accounted for the vast majority (74%, n = 77), followed by doctoral degree holders (24%, n = 25), showing a high

level of education among the participants. In terms of professional title, intermediate title had the highest proportion (52%, $n = 54$), followed by associate senior (18%, $n = 19$) and junior (17%, $n = 18$). This distribution suggests that the sample had a reasonable professional title structure, with most teachers at the intermediate level.

3.3. Data Analysis

Data analysis was conducted using the Statistical Packages for Social Sciences (SPSS) version 26.0. Descriptive statistics, including frequencies, percentages, means, standard deviations, skewness, and kurtosis, were calculated to summarize the demographic characteristics and the distribution of the variables [15].

Reliability analysis was performed using Cronbach's alpha coefficient to assess the internal consistency of the measurement scales [11]. A Cronbach's alpha value greater than 0.7 was considered acceptable.

Validity analysis was conducted using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. A KMO value greater than 0.6 and a Bartlett's test p-value less than 0.05 indicated that the data were suitable for factor analysis and that the questionnaire had good construct validity [14].

Pearson correlation analysis was performed to examine the bivariate relationships between each independent variable (curriculum content integration methods, teachers' competence, and resource allocation) and the dependent variable (integration implementation effectiveness). Correlation coefficients (r) range from -1 to 1, with positive values indicating positive relationships. Correlations were considered significant when $p < 0.05$.

Multiple linear regression analysis was conducted to test the combined effects of the three independent variables on the dependent variable. The regression model also assessed the standardized coefficients (β), R^2 (the proportion of variance explained), and variance inflation factor (VIF) to check for multicollinearity. VIF values between 0.1 and 10.0 were considered acceptable. The significance of the overall regression model was evaluated using analysis of variance (ANOVA), with $p < 0.05$ indicating a statistically significant model. The standardized beta coefficients (β) were used to compare the relative influence of each independent variable on integration implementation effectiveness.

Note: Correlation is significant at the 0.01 level (2-tailed).

--- Indicates that the correlation between independent variables was not reported in the original study.

All significance tests are two-tailed [2, 7].

4. Results

The Pearson correlation results are shown in Table 2. The Pearson correlations between each of the three independent variables and integration implementation effectiveness were all significant and positive [11].

Table 2. Descriptive statistics and correlations among variables ($N = 104$).

No.	Variabl es	Mean	SD	1	2	3	4
1.	Integrati on implem entation effective ness	3.856	0.408	1			
2.	Curricul um	3.984	0.436	0.547**	1		

	content integrati on method s						
3.	Teacher s' comp etence	3.801	0.392	0.507**	—	1	
4.	Resourc e allocatio n	3.708	0.476	0.512**	—	—	1

The multiple linear regression test was carried out to identify the predictive power of the three independent variables on integration implementation effectiveness. The results in Table 3 supported that curriculum content integration methods, teachers' competence, and resource allocation were all significant predictors of integration implementation effectiveness. Curriculum content integration methods ($\beta = 0.289$, $p = 0.005$) was the strongest predictor, followed by resource allocation ($\beta = 0.264$, $p = 0.005$), and teachers' competence ($\beta = 0.216$, $p = 0.029$). The regression model was significant, $F(3, 100) = 22.539$, $p < 0.001$, with an R^2 of 0.403, indicating that the three independent variables jointly explained 40.3% of the variance in integration implementation effectiveness [6, 17]. The relationship was expressed as:

Table 3. Predictors of integration implementation effectiveness (N = 104).

Criterion variable	Predictor variable	F	R ²	df	Beta (β)	t	p
Integration implementation effectiveness	Curriculum content integration methods	22.539**	0.403	(3, 100)	0.289	2.904	0.005
	Teacher s' competence				0.216	2.213	0.029
	Resource allocation				0.264	2.856	0.005

DV (Integration implementation effectiveness) = 1.084 + 0.271 (Curriculum content integration methods) + 0.225 (Teachers' competence) + 0.227 (Resource allocation).

If curriculum content integration methods increase by 1 unit, integration implementation effectiveness will increase by 0.271 units, given that the other variables

are held constant. Furthermore, the table also proved that all three independent variables were positively related to integration implementation effectiveness [17].

Note: $p < 0.001$.

5. Discussion

Higher vocational colleges in Yunnan, like many educational institutions in China, operate under formal educational management models. These models assume that organizations are hierarchical systems, and that managers should use rational approaches to achieve mutual goals. The formal model's characteristics include formal structure, rational decision-making, and "top-down" leadership. As a result, school administrators should take a proactive leadership role in improving the integration of physical education (PE) courses with ethnic minority traditional sports (EMTS). Given the findings of this study, school leaders in Yunnan higher vocational colleges must take more proactive measures.

The survey confirmed that the integration implementation effectiveness was moderate to relatively positive (Mean = 3.856 on a 5-point scale). However, the mean values for curriculum content integration methods (3.984), teachers' competence (3.801), and resource allocation (3.708) indicate that there is still considerable room for improvement. According to the demographic profile, most teachers held master's degrees and intermediate professional titles, yet many reported insufficient training in EMTS teaching and a shortage of specialized venues and equipment. This suggests that without targeted interventions, the sustainability of EMTS integration may be compromised.

The hypothesis test results revealed that all three independent variables—curriculum content integration methods, teachers' competence, and resource allocation—had significant positive impacts on integration implementation effectiveness. Among them, curriculum content integration methods ($\beta = 0.289$, $p = 0.005$) was the strongest predictor, followed by resource allocation ($\beta = 0.264$, $p = 0.005$) and teachers' competence ($\beta = 0.216$, $p = 0.029$). This indicates that school administrators should prioritize curriculum design as the most effective lever for improving integration outcomes.

There are several approaches that school administrators can take to enhance curriculum content integration methods. Schools can develop school-based curricula that incorporate local ethnic characteristics, adopting a "culture-skill-practice" trinity modular design. This includes using documentaries, storytelling, and festival rituals to strengthen cultural cognition, followed by staged technical training and community practice activities. Schools can also establish continuous evaluation mechanisms to monitor integration effects and make timely adjustments. For example, replacing rigid skill-only assessments with diversified evaluations that include cultural understanding and participation can increase student engagement and perceived relevance.

To improve teachers' competence, school leaders should implement systematic training programs. A "theory + practice" training model can be adopted, including learning the history and techniques of EMTS, field visits to observe folk inheritors, and the establishment of an "ethnic sports teacher alliance" for cross-regional collaboration. Inviting intangible cultural heritage inheritors to participate in teaching through a "dual-tutor" system can also bridge the gap between traditional oral transmission and modern standardized instruction.

Regarding resource allocation, school administrators must recognize that adequate venues, equipment, special funding, and digital teaching resources are essential material foundations for successful integration. Schools should establish "college-local collaboration" mechanisms to obtain policy support and resource sharing from local governments and ethnic communities. Rational venue planning, proper fund utilization, and the development of provincial standardized teaching video databases can significantly reduce the "having programs but no venues" dilemma. By improving resource allocation, school leaders can create a supportive environment that enhances teachers' teaching confidence and students' learning experience, ultimately benefiting both educational quality and ethnic cultural inheritance.

6. Limitations and Future Research

Some aspects of this research can still be improved. For example, while the study aimed to provide suggestions for integrating ethnic minority traditional sports into physical education courses in Yunnan higher vocational colleges, it was difficult to provide specific solutions for a specific institutional model because the participants came from five different colleges operating under various management models. Inadequate knowledge of the specific educational management models used by each college made it difficult to propose tailored and actionable solutions. Although all five colleges are higher vocational institutions, there were differences in their ethnic composition, resource endowments, and development levels. As a result, the research could only provide general advice on topics such as curriculum design, teacher training, and resource allocation mechanisms. In the future, researchers can study one or more colleges under a specific educational management model (e.g., formal model or shared governance model) and offer customized solutions based on in-depth institutional analysis.

Aside from the difficulties in providing specific solutions based on institutional models, it was also challenging to conduct an in-depth analysis given the data collected. The close-ended questionnaire was the primary data collection tool. Fixed options, while effective for collecting quantifiable responses, limit the richness of information provided by respondents. For example, while the current dataset could explain which independent variable (curriculum content integration methods, teachers' competence, or resource allocation) had the greatest predictive power, it could not provide reliable explanations for why these relationships exist. It is also difficult to determine why integration implementation effectiveness was only moderate (mean = 3.856) despite relatively high mean scores for the independent variables. Follow-up interviews, focus groups, or classroom observations are necessary if researchers want a robust and in-depth qualitative analysis of the underlying mechanisms [17].

Despite the fact that the dataset was adequate (104 valid responses, exceeding the G*Power minimum of 77), the sample size still limited the generalizability of the research results. Although G*Power analysis justified the sample size for the multiple regression test, the total population of physical education teachers in Yunnan higher vocational colleges is substantially larger. A sample size of 104 may not fully represent the diversity of institutions across the province, particularly those in remote ethnic areas with different resource conditions. As a result, future research should access larger samples covering more higher vocational colleges across different prefectures of Yunnan to obtain more reliable and generalizable conclusions.

Aside from data limitations, the relatively simple conceptual framework influences the adaptability of the research results. There were only three independent variables and one dependent variable, with each independent variable directly pointing to the dependent variable without exploring potential mediating or moderating relationships. In reality, the integration process is more complicated and involves additional elements. For years, scholars have attempted to extend theoretical frameworks with more external constructs. Future research can add more variables---such as students' cultural identity, school leadership support, or policy implementation strength---as mediators or moderators to make the model more adaptable to real-life situations. For example, researchers can test whether students' cultural identity mediates the relationship between curriculum content integration methods and integration implementation effectiveness [17]. Even if scholars do not wish to test other variables, they can examine whether demographic factors such as teaching experience or educational background moderate the relationships. Last but not least, more dependent variable dimensions should be included and tested. Integration implementation effectiveness is a complex concept comprising multiple components, including students' skill mastery, cultural identity, participation enthusiasm, physical fitness improvement, and institutional influence. This study adapted scales from previous research and employed six dimensions, but if more dimensions (e.g., long-term retention of ethnic cultural knowledge or community engagement outcomes) were considered, the evaluation would be more objective and

comprehensive. Future research should also consider using mixed methods (quantitative and qualitative) to capture the richness of the integration process.

7. Conclusion

This research was conducted in the context of higher vocational colleges in Yunnan, China, and targeted a specific group of physical education teachers actively involved in integrating ethnic minority traditional sports into their courses. The study examined the effectiveness of integrating physical education courses with ethnic minority traditional sports. Tyler's curriculum development theory and the TPACK framework guided the research framework, which included four variables: curriculum content integration methods, teachers' competence, resource allocation, and integration implementation effectiveness. The findings revealed significant positive relationships between each of the three independent variables and integration implementation effectiveness. Curriculum content integration methods demonstrated the strongest predictive power ($\beta = 0.289$), followed by resource allocation ($\beta = 0.264$) and teachers' competence ($\beta = 0.216$). To address challenges in managing physical education reform and preserving ethnic cultural heritage in higher vocational colleges, it is recommended that decision-makers and scholars collaborate to optimize curriculum module design, enhance teacher training, and improve college-local collaborative guarantee mechanisms, particularly for institutions adopting formal models for education management in multi-ethnic regions.

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