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Active Learning Approaches and their Impact on Collaborative Competencies in Sports Higher Education: A Systematic Review

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Abstract

This systematic literature review aims to explore the application of active learning methods in higher physical education and their impact on the development of students' collaborative ability. The study strictly follows the PRISMA guidelines framework, systematically searches for relevant literature through Web of Science and Scopus databases and finally includes 18 high-quality studies for in-depth analysis. The study found that the active learning methods used in higher physical education are diverse, including collaborative learning, problem-based learning, gamification, flipped classroom, etc. These methods show multi-dimensional effects in promoting the development of students' collaborative ability, not only improving basic social skills, but also strengthening collaborative motivation, social behavioral norms and inclusive awareness. The study further identified the key factors affecting the effectiveness of active learning, including teacher professionalism, task design characteristics, evaluation methods, curriculum coherence, learning environment and student readiness. The literature analysis also revealed the main gaps in current research, especially the lack of a systematic collaborative ability assessment framework and long-term follow-up research. This review provides a theoretical basis for building a more integrated and dynamic active learning implementation model, and at the same time provides practical inspiration for the effective cultivation of collaborative ability in higher physical education. Future research should focus on the long-term development trajectory of collaborative competence, innovative teaching models supported by technology, and implementation strategies in cross-cultural contexts to further deepen our understanding of this area.

Keywords: Active Learning, Physical Education, Collaboration, Higher Education

Introduction

The global higher education sector is undergoing profound changes, and the transformation of teaching paradigms from traditional knowledge transfer to ability cultivation has become an irreversible trend (Barkley et al., 2014). In this context, physical education, as an important part of higher education, also faces adjustments and reconstructions in its teaching methods and goals. The traditional sports teaching model focuses on skill training and theoretical indoctrination and pays relatively little attention to the cultivation of students' active

participation and collaborative ability (Casey & Goodyear, 2015). With the increasing demand for compound talents in society, collaborative ability has increasingly become one of the core competitiveness of sports graduates (Light, 2008).

Active Learning Approaches, as a teaching strategy that emphasizes learners' active participation and deep thinking, has shown significant results in multidisciplinary fields in recent years (Freeman et al., 2014). This type of method breaks the traditional role positioning of teachers and students, returns the subjectivity of learning to students, and promotes knowledge internalization and ability development by designing structured learning activities. Bonwell and Eison (1991) defined active learning as "teaching activities that promote learning through participation in thinking and reflection", which is highly consistent with the essence of physical education that emphasizes "learning by doing".

The uniqueness of physical education lies in its natural integration of physical activity, cognitive development and social interaction (Kirk, 2013). At the same time, the job market's expectations for the collaborative abilities of sports graduates are increasing, which echoes the reality that teamwork is becoming increasingly important in contemporary work environments (Harvey et al., 2014).

Although theoretical discussions point to a positive relationship between active learning methods and the development of collaborative abilities, existing research has mostly focused on the effectiveness evaluation of a single case or a specific teaching strategy, lacking a systematic and comprehensive literature review and analysis (Goodyear & Dudley, 2015). This research gap limits the comprehensive understanding of the effects of different active learning strategies in physical education and also hinders evidence-based innovation in teaching practices.

Trends of Active Learning Approaches

As a teaching concept and practice, the development of active learning reflects the shift of educational paradigm from traditional teacher-centered to student-centered. Since the 1980s, active learning methods have gradually developed from conceptual advocacy to a diverse teaching strategy system, and have played an important role in global educational reform (Prince, 2004).

Active learning was first systematically explained by Bonwell and Eison (1991), who defined it as "teaching activities that involve students participating in doing things and thinking about what they are doing." This definition emphasizes the learner's subjective participation and thinking input, breaking the role of students as passive recipients in traditional classrooms. With the deepening of educational theory research, the concept of active learning has been continuously enriched. Michael (2006) further described it as "a process that requires students to do things and think about what they are doing through meaningful learning activities." This definition emphasizes the meaning construction and cognitive participation of learning activities. In recent years, active learning has developed from a simple teaching strategy to an educational philosophy. Lombardi (2007) regards it as "a teaching model that promotes critical thinking and autonomous learning through real-world problem solving and experience", which reflects the essential characteristics of active learning and reality.

With the popularization of the concept of active learning, related teaching strategies have shown a diversified development trend. Problem-Based Learning (PBL), as a representative method of early active learning, is widely used in fields such as medicine and engineering (Hmelo-Silver, 2004). Entering the 21st century, the flipped classroom rearranges knowledge transfer and application practice in time and space, becoming an innovative form of active learning (O'Flaherty & Phillips, 2015). At the same time, team-based learning (TBL) promotes deep learning through structured group cooperation (Michaelsen & Sweet, 2011), while situational learning emphasizes building knowledge and abilities in real or simulated professional situations (Lave & Wenger, 1991).

Active learning strategies in the field of physical education have also shown a characteristic development trend in recent years. The Cooperative Learning Model promotes student cooperation by designing active and interdependent learning tasks (Dyson & Casey, 2016); the Sport Education Model simulates real sports events to cultivate students' multi-role abilities (Siedentop et al., 2011); the Teaching Games for Understanding promotes students' in-depth understanding of sports activities by cultivating tactical awareness (Stolz & Pill, 2014).

Constructivist Learning Theory provides epistemological support for active learning, emphasizing the process of learners actively constructing knowledge in social interaction (Light, 2008). Cognitive Load Theory explains how active learning can optimize cognitive resource allocation and improve learning efficiency through task design (Van Merriënboer & Sweller, 2005). Self-Determination Theory explains the mechanism by which active learning promotes autonomy, competence, and relevance from a motivational perspective (Ryan & Deci, 2017). These theoretical studies provide a solid academic foundation for active learning practice.

Trends of Sports Education s in Higher Education

Physical education in higher education is undergoing profound changes. Its development trend not only reflects the evolution of the discipline of physical education itself but also reflects the response to the overall reform direction of higher education. With the adjustment of the society's talent training goals, physical education is expanding from simple physical skill training to an important way to develop the whole person (Kirk, 2013).

Traditional higher physical education mainly emphasizes the mastery of professional sports skills and the improvement of sports performance. The curriculum setting is based on single sports technology, and the teaching method focuses on the demonstration-imitation model (Green, 2008). However, with the evolution of global higher education concepts, the goals of physical education have gradually shifted to more comprehensive ability training and value shaping. Hardman and Marshall (2009) found through a survey of the current status of global physical education that physical education courses in colleges and universities are shifting from traditional "physical education" to a more comprehensive "education through physical activity". This shift emphasizes physical education as a key carrier for cultivating students' all-round development, rather than limited to physical skill training.

The reconstruction of the curriculum system is the core of the reform of higher physical education. Harvey et al. (2014) pointed out that the curriculum design of contemporary

higher physical education pays more and more attention to the integration of theory and practice, breaking the relatively separated state of traditional theoretical courses and practical courses. This integration is not only reflected in the content, but also in the design of the teaching process. In terms of course content, in addition to traditional competitive events, the proportion of health promotion, leisure sports, adaptive sports and other contents is increasing (O'Sullivan, 2013). In terms of course organization, more flexible methods such as modularization, elective system and small class are favored, providing students with more room for independent choice (Fernandez-Rio et al., 2017).

Innovation in teaching methods is another important trend in the development of higher physical education. Although the traditional skill-oriented teaching model is efficient in training specific sports skills, it has limitations in cultivating students' comprehensive abilities. Casey and Goodyear (2015)'s systematic review of collaborative learning models in physical education showed that student-centered teaching methods have significant advantages in promoting students' social skills, emotional development and cognitive engagement. The collaborative learning framework in physical education proposed by Dyson and Casey (2012) emphasizes the cultivation of students' leadership, communication and problem-solving skills through group interaction, role allocation and joint tasks. At the same time, the concept of physical literacy proposed by Kirk (2010) also provides a new conceptual framework for higher physical education, emphasizing the cultivation of students' lasting motivation for participation in sports activities and critical understanding ability based on skill mastery.

The transformation of the evaluation system is a key link in the reform of higher physical education. Traditional sports evaluation mainly focuses on physical performance and standardized test scores, which is difficult to fully reflect the multi-dimensional development of students in sports learning. López-Pastor et al. (2013) found through a systematic review of international sports evaluation research that alternative evaluation methods such as formative evaluation, authentic evaluation and portfolio assessment are increasingly widely used in higher physical education. These evaluation methods pay more attention to the learning process, emphasize student autonomy, and pay more attention to the overall development of abilities, which is highly consistent with the learning outcomes-based education concept emphasized by contemporary higher education (Hay & Penney, 2013).

The impact of digital technology on higher sports education continues to deepen. Casey et al. (2017) pointed out that digital technology not only improves teaching efficiency as an auxiliary tool but also reshapes the form and process of sports teaching as a transformative force. The widespread use of mobile devices enables sports learning to break through the limitations of time and space, providing a more personalized and instant learning experience (Bodsworth & Goodyear, 2017). Video analysis technology provides accurate feedback for skill acquisition and tactical understanding, promoting students' in-depth learning (Palao et al., 2015). In addition, virtual reality and augmented reality technologies create a safe and controllable simulation environment for sports skill learning, providing an innovative supplement to traditional sports teaching (Chang et al., 2020).

Interdisciplinary integration is an important development direction of higher sports education. Ennis (2015) found through a historical investigation of the development of physical education courses that contemporary physical education is breaking through the

boundaries of traditional disciplines and deeply integrating with fields such as health science, psychology, sociology, and management. This interdisciplinary integration not only expands the connotation and extension of physical education, but also provides students with a more comprehensive knowledge structure and ability training platform. The concept of "New Physical Education" proposed by Lawson (2017) emphasizes placing physical education in a broader social and cultural context, focusing on the connection between physical activities and personal development, social justice and sustainable development, and reflects the trend of physical education moving towards a more macro-educational goal.

Internationalization is a significant feature of the development of higher physical education. In the context of globalization, the content, methods and evaluation standards of physical education are increasingly showing a trend of convergence, but at the same time, regional characteristics and cultural differences are also retained (Hardman & Marshall, 2009). Cross-cultural exchanges and cooperation have become an important driving force for the development of sports majors, and international joint training, exchange learning and remote collaboration are becoming increasingly common (MacPhail et al., 2019). This trend not only broadens students' horizons, but also promotes mutual learning and integration of global sports education concepts and practices.

Review on Collaborative Competencies

As one of the core competencies of the 21st century, the concept connotation, structural dimension and cultivation path of collaboration ability have become important topics in educational research.

Roschelle and Teasley (1995) decomposed the collaborative process from a cognitive perspective into four key links: establishing a shared problem space, jointly solving problems, maintaining shared understanding and coordinating actions, emphasizing cognitive synchronization and coordination in collaboration. Hesse et al. (2015) proposed a more systematic collaborative competence structural model, dividing it into two categories: social skills (participation, perspective taking, social regulation) and cognitive skills (task regulation, learning and knowledge construction), and further refined it into multiple specific competence indicators. This model provides a theoretical basis for the measurement and evaluation of collaborative ability, and also points out the direction for the cultivation of ability in educational practice.

In the field of physical education, the study of collaborative ability has unique disciplinary characteristics. Ward and Lee (2005) pointed out that the interactivity, situational nature and physical participation of sports activities make them an ideal carrier for cultivating collaborative ability. Collaborative ability in sports environments not only includes communication and coordination in a general sense, but also places special emphasis on teamwork, role division and tactical coordination in physical activities and competitive situations (Dyson & Casey, 2012). Metzler (2011) divides collaborative ability in physical education into three levels: basic social interaction skills (such as listening, expression, and respect), intermediate task collaboration skills (such as role fulfillment, responsibility sharing, and joint planning), and advanced problem-solving and innovation skills (such as team strategy formulation, challenge response and creative cooperation). This hierarchical

structure reflects the gradual and systematic development of collaborative ability in physical education.

The cross-integration of these theoretical perspectives provides a multi-dimensional explanation for understanding the complex mechanism of collaborative ability development. There are rich research results on the cultivation strategies of collaborative ability in educational environments. The five elements of collaborative learning proposed by Johnson and Johnson (2009) (active interdependence, face-to-face facilitative interaction, individual responsibility, social skills, and group processing) provide a theoretical framework for designing effective collaborative learning activities. Gillies (2016) proved through empirical research that structured collaborative learning task design, clear role division, and effective teacher guidance are key factors in promoting the development of collaborative ability. In physical education, Dyson and Casey (2016) emphasized the importance of task design, pointing out that sports collaborative learning should create real interdependent situations, balance competition and cooperation elements, and provide ample opportunities for reflection. The Sport Education Model proposed by Siedentop et al. (2011) creates an ideal environment for the development of collaborative skills by setting up continuous seasons, stable team belonging and multiple role experiences.

The impact of digital technology on the cultivation of collaborative skills has been a new hot topic in recent years. Jeong and Hmelo-Silver (2016) analyzed how computer-supported collaborative learning (CSCL) promotes knowledge sharing, opinion negotiation and co-construction through technological tools. In physical education, Bodsworth and Goodyear (2017) explored how digital technology breaks the limitations of time and space, expands the boundaries of collaborative learning, and creates new possibilities for interaction. However, the application of technology also faces challenges. How to balance online and offline interactions and how to ensure that technology assists rather than replaces real collaboration still needs further research (Casey et al., 2017).

Research Objectives and Research Questions

Based on the above background analysis, this study aims to systematically sort out the application of active learning methods in higher physical education and its impact on the development of students' collaborative ability. Through a comprehensive review and analysis of existing literature, this study hopes to establish the connection mechanism between active learning methods and the development of collaborative ability, identify effective teaching strategies, and point out the direction for future research. Based on this, 4 research questions are proposed:

RQ1: What types of active learning methods are used in higher physical education?

This research question aims to comprehensively sort out the types, distribution characteristics and implementation methods of active learning strategies that have been implemented in higher physical education. Through the systematic classification and comparative analysis of different active learning methods, the current status and characteristics of active learning applications in higher physical education are revealed, providing a basis for subsequent in-depth analysis.

RQ2: How do these active learning strategies affect the development of collaborative ability of students in higher physical education?

This research question focuses on the relationship mechanism between active learning methods and the development of collaborative ability. By analyzing the impact paths and effects of different active learning strategies on various dimensions of collaborative ability, the intrinsic connection between the two is explored, and the breadth and depth of the impact are evaluated.

RQ3: What situational factors and teaching elements affect the effectiveness of active learning in promoting the development of college students' collaborative ability?

This research question explores the key factors that regulate the effect of active learning. By identifying and analyzing the environmental conditions, teaching design, teacher and student characteristics and other factors that affect the relationship between active learning and collaborative ability development, the necessary conditions and promoting factors for the successful implementation of active learning are revealed, providing targeted guidance for teaching practice.

RQ4: What are the literature gaps in the research on active learning and collaborative ability development in higher physical education?

This research question is committed to identifying the limitations and shortcomings of existing research. By analyzing the research gaps in research methods, theoretical perspectives, research objects and situational coverage, the key areas that need to be focused on in future research are clarified, providing direction guidance for subsequent in-depth research.

By answering the above four research questions, this systematic literature review will provide a comprehensive and in-depth analysis for understanding the application of active learning methods in higher physical education and its impact on the development of collaborative ability, and provide valuable reference for the reform and innovation of higher physical education at the theoretical and practical levels.

Research Significance

This study fills the theoretical gap in existing research by systematically sorting out the association mechanism between active learning methods and the development of collaborative ability. Although active learning and collaborative ability have received widespread attention, there is a relative lack of cross-research on the two in the context of higher physical education. This study will build a bridge between active learning methods and the cultivation of collaborative ability, deepen the understanding of the inherent connection between the two, and provide a new perspective for the integration and innovation of educational theory.

At the level of teaching practice, the findings of this study will directly guide the curriculum design and teaching reform of higher physical education. By refining effective active learning strategies and implementation models, this study provides empirically supported teaching suggestions for physical education workers to help them optimize teaching design and improve teaching effectiveness. These evidence-based practical guidelines will help teachers overcome obstacles to implementing active learning and more effectively cultivate students' collaborative ability.

Methods

This literature review adopts the PRISMA method framework to guide the research process. This choice is based on the recognized authority and rigor of the framework in the field of systematic reviews. The PRISMA framework provides a structured research process to ensure the comprehensiveness of literature collection and the systematicness of analysis, while enhancing the transparency of research and the reliability of results.

In accordance with the PRISMA guidelines, this study was carried out in four stages: first, literature was identified through a specially designed search strategy in a selected database; then, a preliminary screening was conducted based on the title and abstract to eliminate obviously inconsistent literature; then, an in-depth evaluation was conducted through full-text review based on clear standards; and finally, the analysis literature set was determined. **Figure 1** presents the complete screening process. The decision-making basis and changes in the number of literature in each stage are recorded in detail, ensuring the scientificity and repeatability of the research, and laying a methodological foundation for this article's analysis of the application of active learning methods in higher physical education and its impact on collaborative ability.

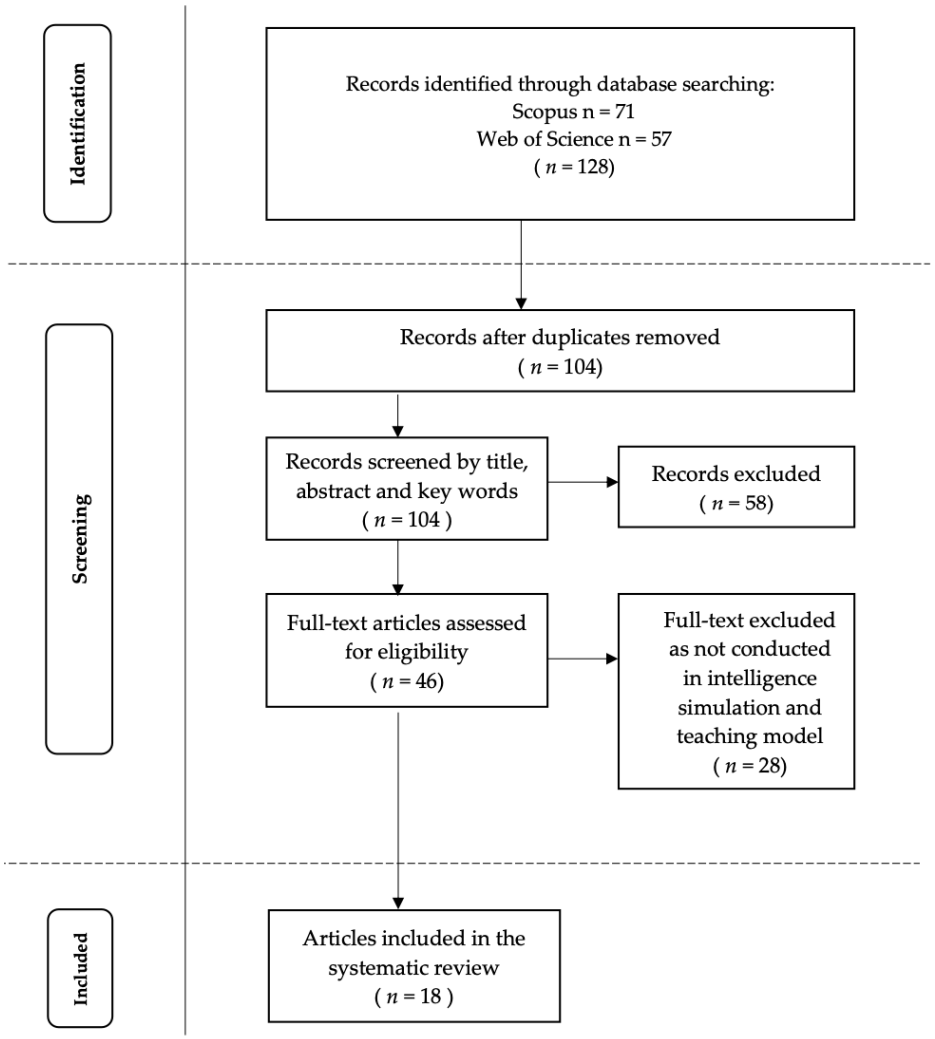

Figure 1 *PRISMA systematic review adapted from.*

Identification

This review study adopted a precise data source selection strategy in the literature identification stage. Based on the strict requirements of the research topic on academic quality, we determined Web of Science (WoS) and Scopus as the core search platforms. These two databases not only contain authoritative journal literature in the field of physical education, but also their complete citation tracking function helps to grasp the development context and knowledge structure of active learning and collaboration research.

The design of the search strategy has undergone multiple optimizations and tests. The research team constructed a set of systematic search terms to ensure comprehensive coverage of the three core research dimensions: active learning methods, sports higher education, and collaboration. The search terms under each dimension include both standard terms and synonyms and variant forms to capture different expressions of related research. In view of the differences in the characteristics of the two databases, the study customized the search strings respectively, used Boolean operators (AND, OR) to combine different concepts, and improved the search accuracy through position qualifiers. **Table 1** lists the final search strategy in detail. This careful design ensures the systematic and comprehensive collection of literature and lays the foundation for subsequent quality assessment and analysis.

Table 1
Search string used in this study.

Database	Search String
Scopus	TITLE-ABS-KEY(("active learning" OR "interactive teaching" OR "flipped classroom*" OR "cooperative learning" OR "collaborative learning" OR "student-centered learning") AND ("sports education" OR "physical education" OR "movement education" OR "sports training") AND ("collaborative behavior*" OR "cooperation" OR "teamwork" OR "peer interaction" OR "social skill*" OR "group learning"))
Web of Science (WoS)	TS=(("active learning" OR "interactive teaching" OR "flipped classroom*" OR "cooperative learning" OR "collaborative learning" OR "student-centered learning") AND ("sports education" OR "physical education" OR "movement education" OR "sports training") AND ("collaborative behavior*" OR "cooperation" OR "teamwork" OR "peer interaction" OR "social skill*" OR "group learning"))

*: Fuzzy Reference

Screening and Included

After the initial search, a rigorous multi-stage screening process was implemented. First, the search results from different databases were checked for duplicates, and a total of 24 duplicate articles were identified and removed, leaving 104 articles for the initial screening stage.

In the initial screening stage, the title, abstract and keywords of these 104 articles were carefully reviewed, focusing on assessing their relevance to the three core themes of active learning methods, higher physical education and collaborative ability development. Through this process, 58 articles that deviated from the research focus were excluded.

Subsequently, the remaining 46 articles were evaluated in full text and screened in depth according to the pre-set inclusion and exclusion criteria. After rigorous evaluation, 18 high-quality articles were finally determined to meet all the criteria of this systematic review and constituted the core analysis objects of this study. The entire screening process maintained a high degree of transparency, and the selection decisions and reasons for each article were recorded in detail, ensuring the reliability and reproducibility of the research.

Data Analysis Procedure

This literature review adopts a structured data extraction framework to systematically analyze the final included literature. To ensure the comprehensiveness and consistency of information collection, we designed a special data extraction matrix to standardize the key elements of each literature.

The data extraction matrix contains five core dimensions: Study (basic literature information, including author, publication year, article title and journal source); Database (source of literature search); Aim (research objectives and core issues); Samples (characteristics of research subjects and sample size); Findings (main research results and conclusions).

The literature analysis process revolves around the four core issues of this study, focusing on the types of active learning methods in higher physical education, the impact mechanism of these methods on the development of collaborative ability, the key factors affecting teaching effectiveness, and the limitations and gaps of existing research (see Appendix 1 for detailed literature review).

Results

Typologies and Characteristics of Active Learning in Higher Education Sports Education

The analysis of the included literature found that a variety of active learning methods have been applied in the field of higher physical education. Montoya et al. (2020) pointed out that students' active learning can significantly enhance students' learning enthusiasm and interpersonal skills, especially the cultivation of students' teamwork awareness. García-Monge and Pérez-Jorge (2021) further proposed a systematic implementation plan for collaborative learning in physical education, and proposed that effective cooperation strategies not only promote students' mutual assistance ability, but also deepen their reflection on the learning process, thus forming a more positive learning atmosphere. From the perspective of theoretical basis, responsibility sharing awareness, interdependence and common goal recognition play a key role in improving classroom cohesion (Jiménez & Antúnez, 2016). In practice, Ayán et al. (2022) designed an inclusive football teaching program based on the concept of collaboration and found that by mobilizing students' active learning, students of different ability levels can be effectively integrated, inclusive awareness and diversified understanding can be enhanced, and it has become an effective way to promote equality in physical education. The basic framework of cooperation verified by Lavy et al. (2017) through empirical research, namely clear rules, interdependent goals and timely

feedback, is mutually confirmed by Delgado et al. (2015)'s conclusion that group interaction promotes knowledge construction and autonomous inquiry.

In the actual teaching process, students' autonomous learning is often achieved through problem-oriented teaching by teachers. After introducing PBL into college physical education courses, Li et al. (2021) found that problem-oriented teaching significantly improved students' active participation and autonomous learning ability, and helped to form a student-centered teaching environment. Esteve's (2024) research also confirmed that problem-oriented teaching involving teaching games enhances students' learning interest and enthusiasm for participation. Specifically at the practical level, Yang et al. (2020) examined the application effect of team game competitions in physical education teaching and found that this method promoted active interaction and cooperative attitude among students.

In the past decade, with the advocacy of the flipped classroom teaching model by the entire education community, the application of flipped classrooms in physical education has gradually increased. Navarro-Flores and de D'Amico (2021) found through empirical research that the flipped teaching model improves classroom learning efficiency and depth of thinking, but also places higher demands on teachers' course design capabilities.

Impact of Active Learning on Collaborative Competencies

Analysis of the included literature shows that active learning methods have a significant effect on improving the collaborative ability of sports students. These effects are reflected in many aspects.

Existing data confirm that collaborative learning significantly improves students' sense of cooperation. Montoya et al. (2020)'s observation records show that students who have experienced cooperative teaching methods are more willing to actively interact with their peers and show a stronger sense of responsibility for team tasks. Especially when faced with team challenges, such students are prone to help each other. This is very consistent with the "interdependence" proposed by Jiménez and Antúnez (2016), indicating that participating in cooperative teaching can indeed help students master practical teamwork skills.

Emotional factors play a key role in the development of collaborative behavior. Yang et al. (2020) accidentally found in their research that students participating in game competition teaching not only communicate more, but also have higher emotional involvement and significantly enhanced interest in learning, which in turn prompted them to actively seek opportunities for cooperation. Similarly, Esteve's (2024) gamification teaching experiment also showed that the way of teaching through entertainnment can enhance learning enthusiasm and cultivate students' sense of collective goals.

Active learning is particularly suitable for developing tolerance and understanding. Ayán et al. (2022) found in their study of mixed football courses for students of different levels that participants gradually learned to accept individual differences and improve their communication skills. This mixed team experience helped students develop a cooperative attitude that respects differences, which is very beneficial for working in diverse teams in the future.

Active learning can also promote the internalization of cooperative behavior. According to Ives-Rubio and López (2017), as students continued to participate in formal sports, their cooperative behavior evolved from simply following the rules to conscious choices. This shift shows that students have internalized cooperation from external requirements to personal values, reflecting the characteristics of active learning that promotes the development of deep abilities.

On the cognitive level, García-Monge and Pérez-Jorge (2021) pointed out that structured cooperative activities can enhance students' ability to analyze the cooperative process, help them recognize the key factors in cooperation, and consciously apply them. This kind of reflective ability lays a solid foundation for students to cope with different cooperative situations.

Key Pedagogical and Contextual Factors Affecting Collaborative Outcomes

Teachers' professional qualities and teaching philosophy play a core role in this process. Álvarez-Castejón and Delgado-Morales (2014) found that physical education teachers who participated in professional training showed a deeper understanding of cooperative learning methods and more proficient application ability, which was directly reflected in the significant improvement of students' cooperative behavior. Interestingly, this influence is not limited to the technical level, but also extends to the teacher's educational philosophy. Hortigüela et al. (2017) found in a study comparing the cognition of "key abilities" by teachers of different subjects that physical education teachers pay more attention to the cultivation of students' cooperative abilities than teachers of other subjects. This difference in educational philosophy directly affects the design and implementation of collaborative elements in the classroom.

The quality of task design is another crucial influencing factor. Lavy et al. (2017) explored the structural elements of effective group cooperation in depth. They found that a successful collaborative learning environment is inseparable from a carefully designed task structure-these tasks need to create real interdependence, ensuring that each member can play a unique role, and at the same time must work together to achieve the goal. When task design lacks this interdependence, so-called "group activities" often become a simple collection of individual work, which is difficult to stimulate real collaborative interaction. This finding echoes the research of García-Monge and Pérez-Jorge (2021), who emphasized that clear cooperation strategies are the key to improving students' collaborative ability. These strategies need to clearly define cooperation rules, role division and interaction methods to provide students with a clear collaborative framework.

The learning evaluation method also significantly affects the collaborative process and results. Although there is no literature specifically studying the impact of the evaluation system on collaborative ability, many studies indirectly touch on this point. Wang (2022) found in his evaluation of the FCT teaching model that when the evaluation system emphasizes team contribution and collaborative process, students show higher classroom discipline and collaborative participation. This shows that the evaluation orientation has a strong guiding effect on student behavior-when collaboration is included in the evaluation criteria, students will naturally pay more attention to teamwork and interaction quality.

The coherence and duration of the course design also significantly affect the development of collaborative ability. The study by Ives-Rubio and López (2017) emphasized that sustained sports participation has a cumulative effect on strengthening social behavioral norms and cooperative awareness. Sporadic collaborative activities are difficult to form stable behavioral patterns, while systematic and long-term curriculum design can internalize collaborative habits into students' natural behaviors. This finding suggests that the cultivation of collaborative ability requires overall planning at the curriculum level, rather than relying solely on a single teaching activity.

The physical and social characteristics of the learning environment also affect the results of collaboration. Moya-Mata et al. (2016) found that although teachers generally recognize the value of collaborative learning, the implementation process is significantly limited by the teaching environment and resource conditions. Environmental factors such as spatial layout suitable for group interaction, sufficient teaching time, and appropriate group size will directly affect the quality of collaborative activities. In addition, Navarro-Flores and de D'Amico (2021)'s study on flipped classrooms also suggests that the availability and reliability of technology-supported environments have an important impact on the effectiveness of collaborative learning.

Student characteristics and readiness are moderating variables that cannot be ignored. Chen and Fang (2014) pointed out in their review of the current status of sports cooperative learning research that students' previous cooperative experience, social skills level and acceptance of cooperative learning will affect the effectiveness of cooperative learning. Especially when students are accustomed to the traditional competitive sports teaching model, they may face adaptation barriers when switching to a collaborative-oriented learning method, and teachers need to provide sufficient guidance and support.

Cultural and institutional backgrounds also constitute a macro-environment that affects the effectiveness of collaborative learning. Alzahrani et al. (2024) found in their analysis of the implementation of the social dimension in physical education that the depth of teachers' understanding of the Sustainable Development Goals was affected by a broader cultural and institutional background. Even if teachers effectively integrate cooperative learning and social responsibility education in the classroom, the depth and durability of these teaching practices may be limited if there is a lack of systematic policy support and value recognition.

Discussion

Rethinking the Boundaries of Active Learning in Sports Education

Looking at these selected literatures comprehensively, existing research can further confirm that active learning in the context of sports disciplines has unique characteristics and is difficult to fully cover with a general definition. Unlike theoretical disciplines, learning activities in sports teaching situations naturally combine thinking challenges, physical participation, and social interaction. Yang et al. (2020) conducted research on group teaching games and Esteve (2024) analyzed gamified teaching and showed that when students solve cognitive tasks through physical activities, emotional experience and knowledge construction processes promote each other and are difficult to separate. This phenomenon shows that active learning in sports teaching requires the development of specific theoretical explanations rather than simply transplanting other disciplinary frameworks.

Active learning and collaborative ability in physical education show a close two-way relationship. From the research of Montoya et al. (2020) and Jiménez and Antúnez (2016), it can be seen that collaboration is both a means of implementation of these teaching methods and one of the goals they hope to achieve. This cyclical relationship makes physical education an ideal environment for developing collaborative ability, and also encourages physical education teachers in higher education institutions to regard active learning as a systematic process of ability development rather than a simple teaching technique.

Looking at the past teaching cases with research value, successful teaching cases in practice often break the boundaries of method types. The FCT model proposed by Wang (2022) and the flipped classroom practice discussed by Navarro-Flores and de D'Amico (2021) both show that contemporary physical education is moving towards the direction of comprehensive methods and flexible application. This suggests that future research on physical education teaching models in higher education should go beyond simple method classification and pay more attention to how different strategies can be organically combined to adapt to specific teaching goals.

One point worth emphasizing here is the transformation of the role of teachers. Álvarez-Castejón and Delgado-Morales (2014) proposed through research that teachers' professional qualities directly affect the implementation quality of active learning. This shows that active learning is not only a choice of teaching strategies, but also involves fundamental changes in teachers' professional identity and educational concepts. This point is of high value and significance, and it should be paid special attention to when discussing innovation in physical education.

How Does Collaboration Emerge in Active Learning Environments?

Collaborative behavior in the field of physical education is not the result of simple indoctrination, but is naturally generated under specific conditions. The interdependent task design in sports activities forms the soil for collaboration. Lavy et al. (2017) observed that when students face challenges that they cannot complete alone, cooperation occurs naturally. Interestingly, this "forced cooperation" may initially originate from external pressure, but it soon turns into an internal motivation to solve the problem. Students gradually discover that only sincere cooperation can break through difficulties—this understanding is far more powerful than any preaching.

Emotional bonds are the catalyst for the formation of collaboration. Yang et al. (2020) recorded a phenomenon in a team game: when the team members celebrated the score together and experienced setbacks together, an indescribable link was generated between the originally unfamiliar classmates. This emotional connection makes cooperation no longer the result of rational calculation, but a natural tendency. As Esteve (2024) said, the emotional resonance created by gamification activities allows students to open their hearts and accept each other's ideas unconsciously.

The formation of group identity marks the deep development of collaboration. Ayán et al. (2022) found an interesting shift in football teaching: initially, students focused on "my performance" and "their performance", and after a period of time, they began to use expressions such as "our tactics" and "our goals". This change in language reflects a

fundamental shift in thinking - when students see themselves as part of a team, collaboration is no longer an external rule, but a natural extension of identity.

Further reflection and accumulation of time on this basis are the key to the good role of student autonomous learning in physical education. García-Monge and Pérez-Jorge (2021) found that students who had the opportunity to analyze the teamwork process developed more lasting collaborative skills than students who only had collaborative experience. This "thinking while doing" process allows students to not only mechanically perform the steps of cooperation, but also understand the principles behind it, so that they can flexibly apply these abilities in new environments. From a longer-term perspective, ves-Rubio and López (2017) found that students' cooperative behavior patterns are not achieved overnight, but are gradually internalized through repeated practice. This is similar to the general law of students' understanding of things. From unfamiliar to proficient, from deliberate to natural, it takes enough time and practice. Of course, it should be emphasized that students' subjective initiative in learning does not mean that teachers' work is unimportant. The guidance and guidance role of college physical education teachers in teaching practice directly determines how students react in the long run and what kind of "learned conditioned reflexes" students gradually develop in daily life. Álvarez-Castejón and Delgado-Morales (2014) noted that professionally trained teachers do not directly tell students "how to cooperate", but create situations for students to discover the necessity and methods of cooperation. This indirect guidance can cultivate a real and lasting sense of collaboration better than direct instructions. From Wang's (2022) FCT model research, it can be seen that when students feel that their contributions are valued, the quality of collaborative behavior will be significantly improved. This transformation from "having to participate" to "eager to contribute" may be a sign of the true maturity of collaborative ability.

Designing for Context: When and Why Collaboration Works

The nature of the teaching objectives significantly affects the direction of collaborative design. When the teaching objectives emphasize skill acquisition, such as the flipped classroom case studied by Navarro-Flores and de D'Amico (2021), collaboration needs to be balanced with individual practice, and over-reliance on in-group mutual assistance may hinder the individual skill development of some students. In contrast, when the objectives focus on social responsibility and inclusive awareness, such as the inclusive football program of Ayán et al. (2022), heterogeneous grouping and process-oriented evaluation methods can achieve the greatest effect. This difference suggests that collaborative design should first consider the basic question of "why collaboration" and clarify the functional positioning of collaboration in achieving specific teaching objectives.

Learners' readiness and background constitute key considerations for collaborative design. Chen and Fang (2014) pointed out that students' previous collaborative experience significantly affects the effectiveness of collaborative learning. For learners with limited collaborative experience, more structured task design and clearer role allocation are needed; for learners who already have basic collaborative skills, more open and challenging collaborative tasks can be introduced. This differentiated design based on learner characteristics requires teachers to have keen observation skills and flexible teaching adaptation capabilities.

The impact of cultural background and institutional environment on collaborative learning cannot be ignored. Alzahrani et al. (2024) showed that even if similar collaborative methods are adopted, the implementation effects in different cultural backgrounds may vary significantly. This finding suggests that collaborative design needs to take into account the value orientation of cooperation, competition, authority and personal achievement in the local culture, and avoid simply copying foreign models and ignoring cultural adaptability.

The time factor has unique significance in collaborative learning design. Ives-Rubio and López (2017) emphasized that continuous sports participation has a cumulative effect on the cultivation of collaborative behavior. This shows that effective collaborative design should consider long-term development paths rather than focusing only on the effects of a single activity. Short-term collaborative activities may bring immediate participation, but the cultivation of deep-level collaborative abilities requires systematic and continuous teaching design to form a clear ladder of ability development.

The cognitive complexity of the task is closely related to collaborative design. Delgado et al. (2015) showed that group collaboration has unique advantages in promoting knowledge construction and autonomous inquiry. When the task requires high-level thinking and multi-angle analysis, collaborative learning is often more effective than individual learning; while for simple memory or basic skill training, the advantages of collaboration are not obvious. This finding suggests that collaborative design should be applied to complex cognitive tasks first to give full play to the advantages of collective wisdom.

The teacher's guidance method directly affects the quality of collaboration. Álvarez-Castejón and Delgado-Morales (2014) found that the depth of teachers' understanding of collaborative learning determines its implementation effect. Successful collaboration is not letting go or over-intervention but providing structured guidance at the right time. This kind of "scaffolding" guidance requires teachers to be sensitive to the group dynamics, provide necessary support when students encounter bottlenecks, and not interfere with the natural process of autonomous collaboration of the group.

Toward a Robust Framework for Evaluating Collaborative Competencies

Literature analysis reveals that the current evaluation of collaborative ability in higher physical education still has obvious limitations, and a systematic and comprehensive evaluation system has not yet been formed. This gap not only affects the scientific nature of teaching evaluation, but also restricts the effectiveness of collaborative ability training. Based on the comprehensive research findings of the included literature, building a more complete collaborative ability evaluation framework has become a key issue that needs to be solved urgently.

Existing evaluation practices mostly stay at the level of surface behavior observation, lacking in-depth measurement of the internal structure of collaborative ability. Although Montoya et al. (2020) reported the positive impact of collaborative learning on social skills, the evaluation method mainly relied on teacher observation and self-reporting, which made it difficult to objectively capture the multidimensional characteristics of collaborative ability. This phenomenon is common in many studies, reflecting the limitations of the evaluation tools. A more systematic evaluation framework should be based on the structural model of

collaborative ability, covering multiple dimensions such as cognition, emotion, behavior and metacognition.

The evaluation time point is too focused on short-term effects, ignoring the long-term trajectory of collaborative ability development. Ives-Rubio and López (2017) pointed out that continuous sports participation has a cumulative effect on collaborative behavior. This finding suggests that the evaluation of collaborative ability should be carried out in a long-term tracking manner. The future assessment framework needs to design phased assessment points to record the development and changes of students' collaborative ability and reveal the characteristic performance and qualitative change nodes of different stages.

The homogeneity of assessment contexts limits the transformative assessment of collaborative ability. Most studies limit the assessment to specific courses or activities, such as Yang et al.'s (2020) study on team game competitions, which lacks the measurement of cross-context collaborative ability. Considering that the true value of collaborative ability lies in its application in diverse environments, the ideal assessment framework should create diverse contexts to test the transferability and adaptability of students' collaborative ability.
The insufficient application of technology-supported assessment methods limits the accuracy and multidimensionality of the assessment. Although Casey et al.'s study mentioned the application of digital technology in physical education teaching, technological innovation in the field of assessment is still insufficient. Innovative assessment methods such as collaborative process tracking, automated interaction analysis, and multi-source data integration based on technical means have the potential to significantly enhance the breadth and depth of collaborative ability assessment.

The lack of integration between self-assessment and other assessment affects the comprehensiveness of the assessment perspective. García-Monge and Pérez-Jorge (2021) emphasized the value of reflection in the development of collaborative ability, which suggests that self-assessment should be an integral part of the collaborative ability evaluation system. A multi-evaluation system that combines teacher evaluation, peer evaluation, and self-evaluation can provide a more three-dimensional portrait of collaborative ability.

The ambiguity and subjectivity of the evaluation criteria limit the comparability and consistency of the evaluation results. Although the FCT teaching model evaluated by Wang (2022) focuses on collaborative participation, the evaluation criteria lack precise definition. Future evaluation frameworks need to establish clear and operational performance indicators to ensure the objectivity of the evaluation process and the reliability of the results.

The disconnection between evaluation and feedback weakens the formative function of evaluation. Many studies focus on evaluation results, but less on how to transform evaluation into effective feedback to guide students to improve collaborative behavior. The ideal evaluation framework should strengthen the connection between evaluation and feedback, forming a closed-loop system of "evaluation-feedback-improvement" to maximize the educational value of evaluation.

Based on these findings, a systematic collaborative ability assessment framework should have the following characteristics: a multidimensional assessment design based on the

collaborative ability structure model; a longitudinal assessment strategy combining short-term and long-term tracking; the creation of diverse scenarios to test ability transferability; an innovative assessment method that integrates technology support; a fusion of self-assessment, peer assessment, and teacher assessment perspectives; the establishment of clear and operational ability performance standards; and the strengthening of the organic connection between assessment and feedback. This framework not only helps to more scientifically and comprehensively assess students' collaborative abilities, but also provides strong support for teaching improvements and promotes the precision and personalization of collaborative ability training.

Conclusion

This systematic literature review comprehensively analyzes the research on active learning methods in higher physical education and their impact on the development of collaborative ability. Through rigorous screening and systematic analysis, 18 high-quality literatures were finally included, and the following conclusions were drawn around four core research questions.

Regarding the types of active learning methods used in higher physical education, the study found that a variety of methods have been widely used, including collaborative learning, problem-oriented learning, gamification teaching, flipped classrooms, and comprehensive innovation models. Although these methods have their own characteristics, they all reflect common characteristics such as student-centeredness, emphasis on interaction and collaboration, focus on contextualized learning, integrated reflection and evaluation, and teacher role transformation. Collaborative learning is the most widely used method, and its various variants, such as interdependent group learning, structured task collaboration, and inclusive team activities, show unique adaptability in physical education.

Regarding the impact of active learning strategies on the development of collaborative ability, the study shows that this impact is multidimensional, involving not only the improvement of basic social skills, but also the enhancement of collaborative motivation, the internalization of social behavioral norms, the cultivation of inclusive diversity awareness, and the development of collaborative process management capabilities. Active learning methods form an ecosystem for the emergence of collaborative capabilities by creating real interactive situations, stimulating positive emotional experiences, building collective identity, and promoting internalization of reflection, thus realizing the transformation process from external rule constraints to internal collaborative motivation.

Regarding the contextual and teaching factors that affect the effectiveness of active learning in the development of collaborative capabilities, the study identified multi-level influencing factors, including teacher professionalism and educational philosophy, the interdependence and challenge of task design, the collaborative orientation of evaluation methods, the coherence and continuity of curriculum design, the physical and social characteristics of the learning environment, student characteristics and readiness, and cultural and institutional background. These factors interact with each other to form a complex network of influences, suggesting that collaborative learning requires contextualized and precise design, and the implementation strategy should be adjusted according to specific teaching objectives, learner characteristics, and environmental conditions.

Regarding the gaps and deficiencies in existing research, the analysis found the following main aspects: insufficient theoretical discussion on the unique nature of active learning in physical education; lack of follow-up research on the long-term effects of collaborative ability development; the systematic framework for collaborative ability evaluation has not yet been established; limited research on innovative models integrating active learning methods with digital technology; lack of comparative research on active learning implementation in cross-cultural contexts; and insufficient in-depth research on the relationship between teacher professional development and the effectiveness of active learning implementation. Especially in terms of evaluation, current practices mostly stay at the surface behavior observation, lacking a multi-dimensional, long-term tracking, cross-context, and technically supported systematic evaluation system.

Based on these findings, this study puts forward the following suggestions for higher physical education practice: First, go beyond simple method classification and build a more integrated and dynamic active learning implementation framework; second, pay attention to the deep mechanism of collaborative ability development and design targeted teaching intervention strategies; third, attach importance to the systematic design of the teaching environment and create a learning ecology that is conducive to the emergence of collaboration; fourth, establish a multi-dimensional, long-term tracking collaborative ability evaluation system to strengthen the connection between evaluation and feedback; fifth, strengthen teacher professional development and enhance their ability to design and guide active learning environments.

Future research directions should focus on: conducting more longitudinal tracking studies to explore the long-term development trajectory of collaborative ability; developing innovative active learning models that integrate digital technology; building a collaborative ability structure model and evaluation framework that is suitable for the characteristics of physical education; exploring adaptive strategies for active learning implementation in a cross-cultural context; and in-depth research on the impact mechanism of teacher professional development on the implementation effect of active learning.

Through these theoretical explorations and practical innovations, higher physical education is expected to apply active learning methods more systematically and effectively, cultivate students' collaborative ability, and lay a solid foundation for their future career development and social participation.

The contribution of this study at the theoretical level is reflected in the systematic integration of two core educational issues: active learning and collaborative ability training, especially in the unique context of higher physical education. The study clearly reveals the collaborative promotion path of different active learning methods. Based on social interdependence theory, constructivist learning theory and autonomous motivation theory, it proposes a new view that "collaborative ability development is an inherent product of active learning rather than an additional result", which provides a new perspective for the development of relevant educational theories.

In terms of contextual significance, this study responds to the practical needs of "interdisciplinary ability training" in higher education reform, and pays special attention to

the physical and contextual characteristics of collaborative training in the field of physical education. The key influencing factors identified in the study - including teacher professional development, curriculum continuity design, cultural adaptability, etc. - provide targeted guiding principles for the teaching practice of higher physical education. These findings not only enrich the understanding of the application mechanism of active learning in a professional education environment, but also provide theoretical support and practical direction for the reform of physical education and the construction of a collaborative ability evaluation system in a cross-cultural context.

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