

A Comprehensive Evaluation System of Practical Ability of Physical Education Teaching Based on Classification and Clustering Algorithm

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Abstract—The practical ability is an important skill of college students majoring in physical education (PE). It can be subdivided into general practical ability and professional practical ability. This paper summarizes the current state of PE teaching practice in colleges, and applies classification and clustering algorithm to the comprehensive evaluation of the practical ability of PE teaching. The results show that the practical ability of PE majors is empirical, contextual, developmental, and personal. During the self-evaluation of practical ability, communication ability won the highest satisfaction among PE majors. In terms of social PE coaching ability, interpersonal communication ability won the highest satisfaction among PE majors. The research findings of this paper lay a basis for the curriculum reform of PE major, and the comprehensive evaluation of education practical ability.

Keywords—physical education (PE), practical ability, classification and clustering algorithm, satisfaction

1 Introduction

The cultivation of practical ability is related to a series of major issues such as whether a talent has the condition to engage in relevant works, whether he/she can adapt to the requirements of social development, and whether the talent can give full play to his/her potentials, abilities, and strength [1]. Now, the education field in China has attached great importance to the cultivation of students' practical ability, efforts are made to enhance their creative ability, and employment has been taken as the goal for talent training [2, 3]. PE teaching requires PE teachers not only to teach students how to master certain skills, but also to enhance their practical ability through skill learning [4, 5]. College PE teachers should try their best to provide students with as many opportunities as possible to practice, so that the PE majors could training their practical ability through their own practice [6].

PE teachers' solid and excellent practical ability and good adaptation to PE teaching works of colleges are the basic guarantees for the creation of a new image in college PE teaching [7]. The comprehensive evaluation of practice ability of PE teaching

is a value judgment activity with the PE practical ability as the object [8]. The evaluation of students' PE practical ability is an important link in PE teaching, which has a far-reaching significance for improving talent quality, optimizing teaching management, indicating deficiencies in PE teaching, and providing decision-making suggestions for teaching administrators [9]. The comprehensive evaluation of PE practical ability has always been a weak link in the education evaluation of colleges, which has adversely affected the further deepening of PE teaching reform [10, 11].

The evaluation of students' practical ability is carried out based on the cultivation goals, the value judgment of the practical ability makes students be aware of their own strengths and weaknesses, so that they could clarify their learning objectives, and actively strengthen their practical ability [12]. Every few years, colleges will revise their PE teaching plans and adjust the evaluation index system of PE teaching in order to adapt to the development of PE teaching and the ever-changing teaching requirements [13, 14]. Scholars successively propose that attentions should be paid to the cultivation of PE majors' expression ability, organization ability, design ability, environment adaption ability, self-learning ability, reform ability, and social competition ability [15]. Based on current state of college PE teaching practice, this paper applied the classification and clustering algorithm to the comprehensive evaluation of the practical ability of PE teaching.

2 Current state of practical ability of PE teaching

2.1 Subjects and methods

The practical ability of PE teaching includes the sports exercising ability, sports entertaining ability, sports watching ability, and sports learning ability, etc. [16]. In order to cultivate versatile application-type sports professionals with rich knowledge and comprehensive ability, colleges must reform their practical teaching constantly, arrange the time of practical teaching reasonably, expand the organization forms of PE teaching, and optimize the administration mode of PE teaching practice [17, 18]. Some scholars carried out tracking assessment on the practical ability of PE majors of multiple colleges, after four years of cultivation, they found that the students' practical ability indeed improved and they generally had very good teaching training ability [19, 20]. To figure out the current state of practical ability of PE teaching in Chinese colleges, this study took a few PE majors from colleges and universities Guangdong province China as the subjects to investigate their professional practical ability under the current PE teaching, and found out their cultivation situations and underlying problems. Table 1 lists some information about the survey. Figure 1 shows the construction flow of the evaluation index system. The classification and clustering algorithm had been adopted, after the evaluation objects were determined, through literature review and expert consulting methods, the indexes of each level were preliminarily determined, then the experts were invited to screen the indexes of each level; after that, combining the expert opinions, indexes were finally determined and the evaluation index system was constructed.

Table 1. Information about the survey

Respondent	Questionnaires sent out	Questionnaire returned	Effective copies	Effective rate/%
PE majors	220	217	212	96.36%

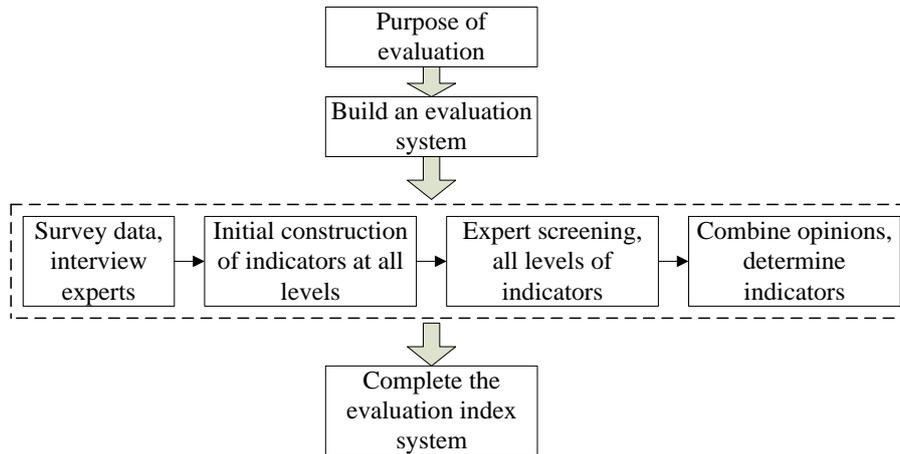


Fig. 1. Construction flow of the evaluation index system

2.2 Analysis of current state of practical ability of PE teaching

The practical ability of PE teaching refers to the ability to use knowledge and skills in PE teaching to solve various problems encountered in the process of PE teaching, and the skill practice is the most important thing in it [21, 22]. The scientific and cultural knowledge is the foundation of practical ability of PE teaching, then through practical links, it is transformed to various abilities and applied in practice [23, 24]. The practical ability of PE students specifically refers to the comprehensive skills of integrating theoretical knowledge with practical activities during PE teaching and other relevant practical works [25, 26]. Figure 2 lists the summarized features of the professional practice ability of PE majors, which are empirical, contextual, developmental, and personal.

Professional practical ability is the necessary foundation of PE teaching and the core ability of PE majors to complete the practical works in the sports field in the future [27]. Figure 3 shows the statistics of PE students' understanding of the importance of professional practice ability, it can be clearly seen that 56.7% of the respondents think that the professional practical ability is very important, those who think professional practical ability is relatively important or important accounted for 25.77% and 10.31%, respectively. On the whole, more than 90% of PE students believe that professional practical ability is important. The satisfaction of students with their own professional practical ability reflects their familiarity and mastery of PE practical ability [28]. Figure 4 shows the self-evaluation of PE students on their professional practical ability. According to statistics, students who are very satisfied, relatively satisfied, and satisfied with their own professional practical ability account-

ed for 4.63%, 13.89%, and 41.67%, respectively; overall speaking, about 70% of the students are satisfied with the level of their professional practical ability.

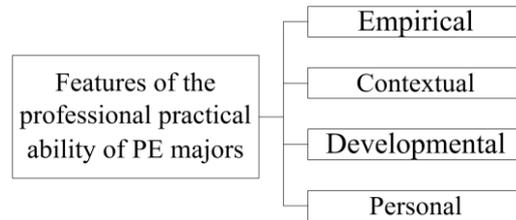


Fig. 2. Features of the professional practical ability of PE majors

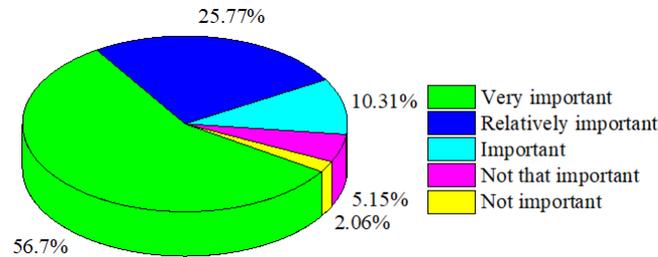


Fig. 3. Statistics of PE students' understanding of the importance of professional practical ability

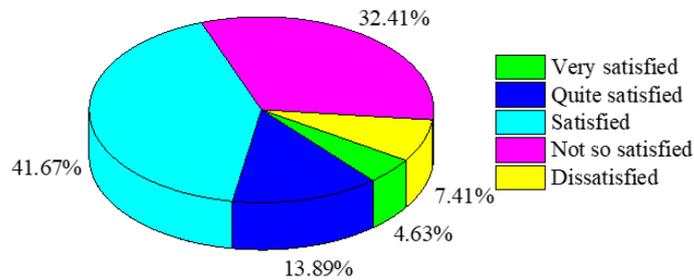


Fig. 4. Self-evaluation of PE students on their professional practical ability

The practical ability of PE students includes: learning ability, communication ability, expression ability, and teamwork ability. Figure 5 shows the statistics of PE students' self-evaluation on their practical ability. The satisfaction rate of learning ability exceeds 80%; the satisfaction rate of communication ability is close to 90%; the satisfaction rate of expression ability exceeds 80%; and the satisfaction rate of team work ability exceeds 75%. Comparing with the survey results of other abilities, the communication ability won the highest score of satisfaction. The social practical ability includes the activity organization ability, activity coaching ability, interpersonal communication ability, exercise prescription ability, and physical fitness evaluation ability.

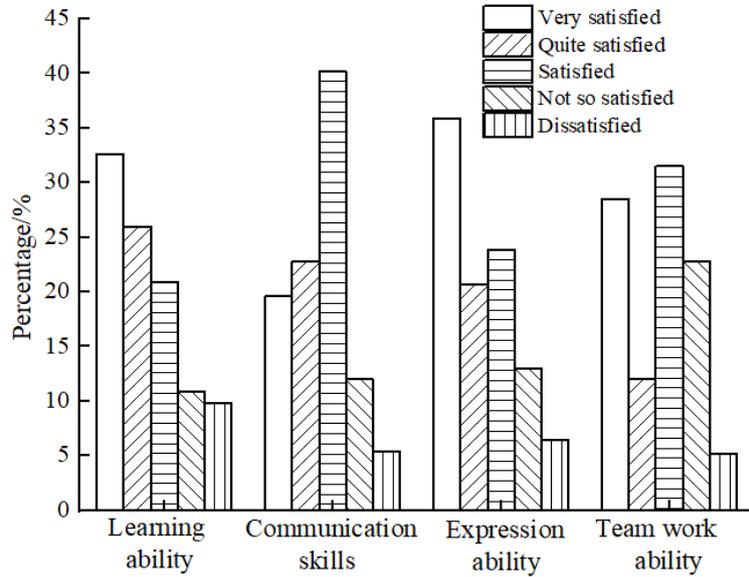


Fig. 5. Statistics of PE students' self-evaluation on their practical ability

Figure 6 shows the statistics of PE students' satisfaction with their social practical ability, the interpersonal communication ability won the highest satisfaction rate which exceeds 70%, followed by the activity organization ability, the physical fitness evaluation ability, the exercise prescription ability, and the activity coaching ability; overall, the satisfaction rate of PE students with their social practical ability exceeds 50%. Figure 7 shows the statistics of PE students' self-evaluation on their moral education ability, the ability of being a virtue model won the highest satisfaction rate, which exceeds 90%, followed by the ability to impart knowledge and teach students, and the ability to manage and educate students.

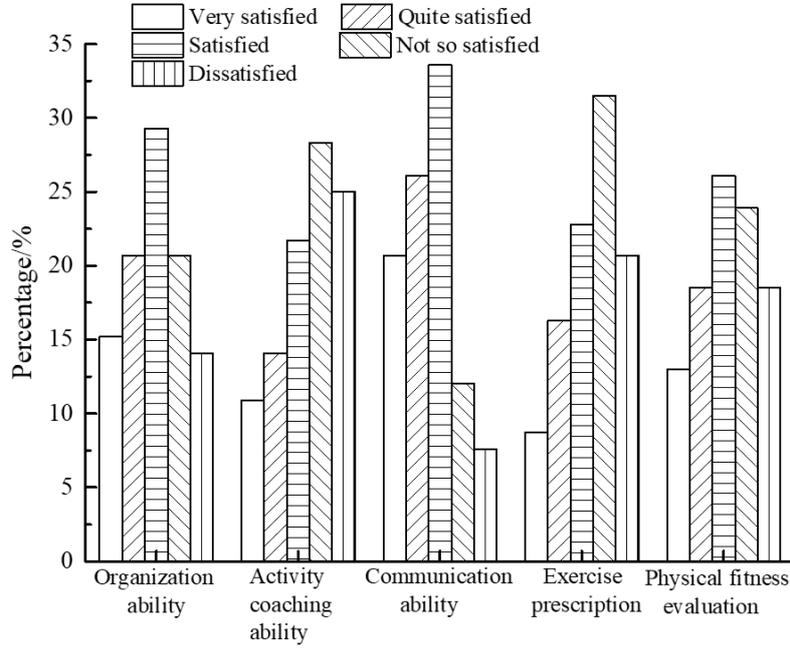


Fig. 6. Statistics of PE students' satisfaction with their social practical ability

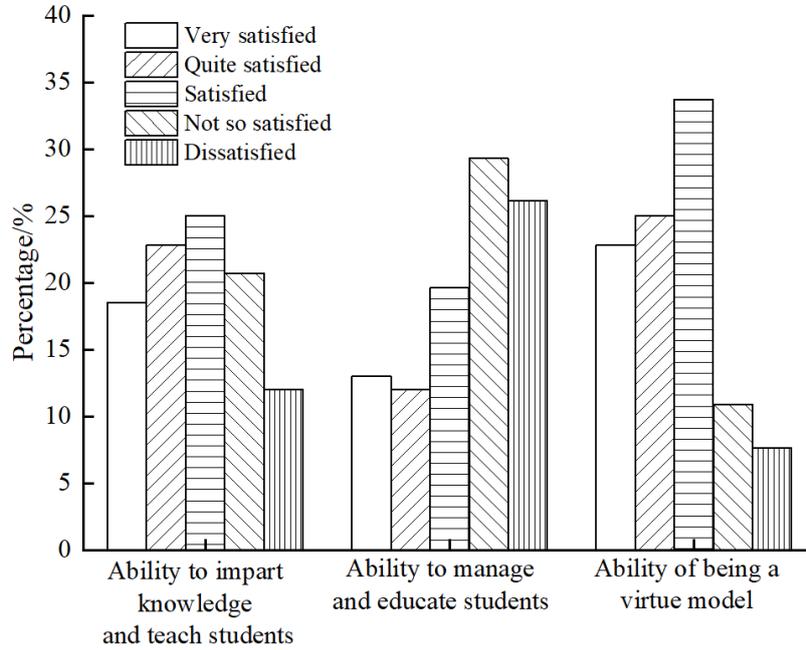


Fig. 7. Statistics of PE students' self-evaluation on their moral education ability

2.3 Reasons for shortcomings in the practical ability of PE teaching

Through investigation and research, we found that there're many shortcomings with the practical ability of PE teaching, thus this paper summarized the reasons for these shortcomings and listed them in Figure 8. At first, colleges haven't given enough attention to the cultivation of students' professional practical ability, which is mainly manifested as the insufficient theoretical knowledge, the incompetent teaching ability, and the poor teaching method, and these have greatly affected the improvement of the PE teaching quality in colleges. Second, the teaching mode is too single and not integrated, the school training process values knowledge imparting over skill training, which has brought an adverse impact on students. Third, the curriculum setting of the major is inappropriate, the setting of many elective courses has hindered the development of students' personality and overall quality. Fourth, the textbooks are outdated, the teaching content is falling behind the development of the discipline, and the selection of the teaching materials cannot keep up with the development of sports and the times, Fifth, there're too few PE teaching internship and practice opportunities, colleges generally attach insufficient attention to the PE teaching internships, so students do not have a good channel of education practice. At last, there isn't an effective assessment or evaluation system, and the traditional sports skill evaluation runs counter to the objective of physical education.

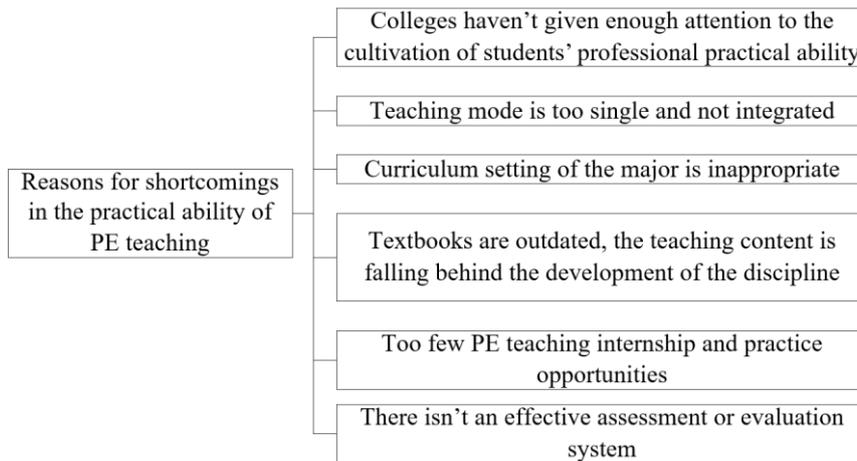


Fig. 8. Reasons for shortcomings in the practical ability of PE teaching

3 EIS (evaluation index system) construction

3.1 Determination of indexes

Figure 9 shows the principles of index selection for assessing the practical ability of PE teaching, including the concise and scientific principle, the typical principle, the systematic principle, the comprehensive principle, and the comparable, controllable,

and operable principle. The EIS of the practical ability of PE teaching shouldn't be too complicated, and the selected indexes shouldn't overlap with each other [29, 30]. Moreover, the selected indexes could be used for data calculation, the calculated results should be accurate, and these indexes mustn't affect the data analysis or the accurate application of the results [31]. When giving evaluations, the value scale of evaluators should be scientific and reasonable, and the evaluation results should reflect the objective cognition and values of the evaluation experts.

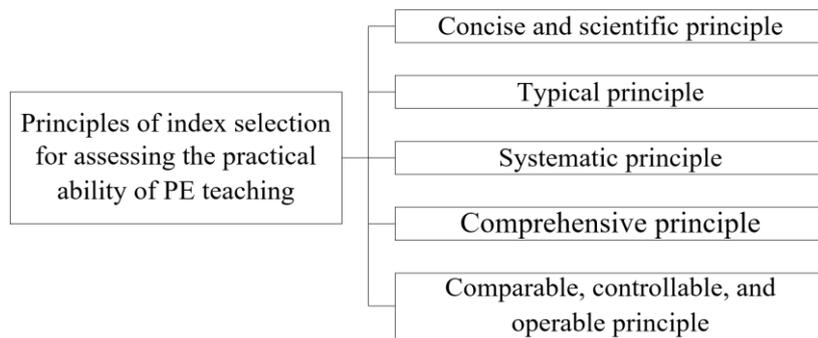


Fig. 9. Principles of index selection for assessing the practical ability of PE teaching

3.2 Content of selected indexes

The classification and clustering algorithm had been applied in the study. Experts were invited to give scores to the four first-level evaluation indexes: teaching design ability, teaching implementation ability, teaching reflection and evaluation ability, and other practical ability. The recognition rate of 26 experts for these four first-level evaluation indexes is 100%, as shown in Figure 10. In the scores given by experts, the teaching implementation ability got the highest score, followed by the teaching design ability and the teaching reflection and evaluation ability. Table 2 lists the scores of second-level indexes for assessing the practical ability of PE teaching. There're 14 second-level indexes, among which three got a 100% expert recognition rate, namely the ability to use teaching materials, the action explanation ability, and the feedback enhancement ability. The ability to choose teaching methods got the highest score from experts, followed by the action demonstration ability, the ability to use teaching materials, and the special program training ability.

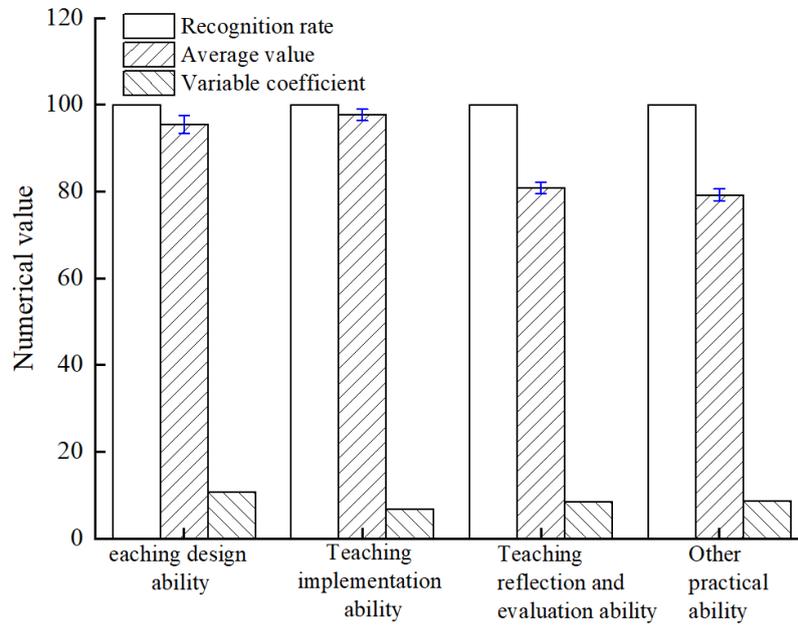


Fig. 10.Recognition rates of experts for the four first-level evaluation indexes

Table 2. Scores of second-level indexes for assessing the practical ability of PE teaching

Index	Recognition rate	Average value	Standard deviation	Variable coefficient
Use teaching materials	100	93	2.45	11.34
Ability to develop teaching documents	97.22	82.3	2.11	9.43
Ability to choose teaching methods	98.31	99.5	1.97	11.13
Action explanation ability	100	90.21	1.56	15.39
Action demonstration ability	94.22	94.1	2.89	14.72
Wrong action correction ability	97.82	90.8	2.32	12.09
On- spot adaptive teaching ability	97.44	89	2.76	15.36
Teaching organization and management ability	98.39	90	1.89	15.31
Teaching process evaluation ability	99.48	89.29	1.27	13.95
Feedback enhancement ability	100	87.34	1.66	14.65
Special program training ability	87.66	90.22	2.65	14.44
Scientific research and innovation ability	89.90	87.63	2.56	15.21
Creative ability	92.30	79.77	2.39	14.65
Sports and social activity Ability	84.78	74.37	1.90	12.77

Figure 11 shows the proposed EIS of the practical ability of PE teaching. In this EIS, there're three first-level indexes: teaching design ability, teaching implementation ability, and teaching reflection and evaluation ability. Wherein, the teaching design ability includes the ability to use teaching materials, the ability to develop

teaching documents, and the ability to choose teaching methods; the teaching implementation ability includes the action explanation ability, the action demonstration ability, the wrong action correction ability, the protection and assistant ability, on-spot adaptive ability, teaching organization and management ability, teaching resource utilization ability, and special program training ability; the teaching reflection and evaluation ability only includes two items, the teaching process evaluation ability, and the feedback enhancement ability.

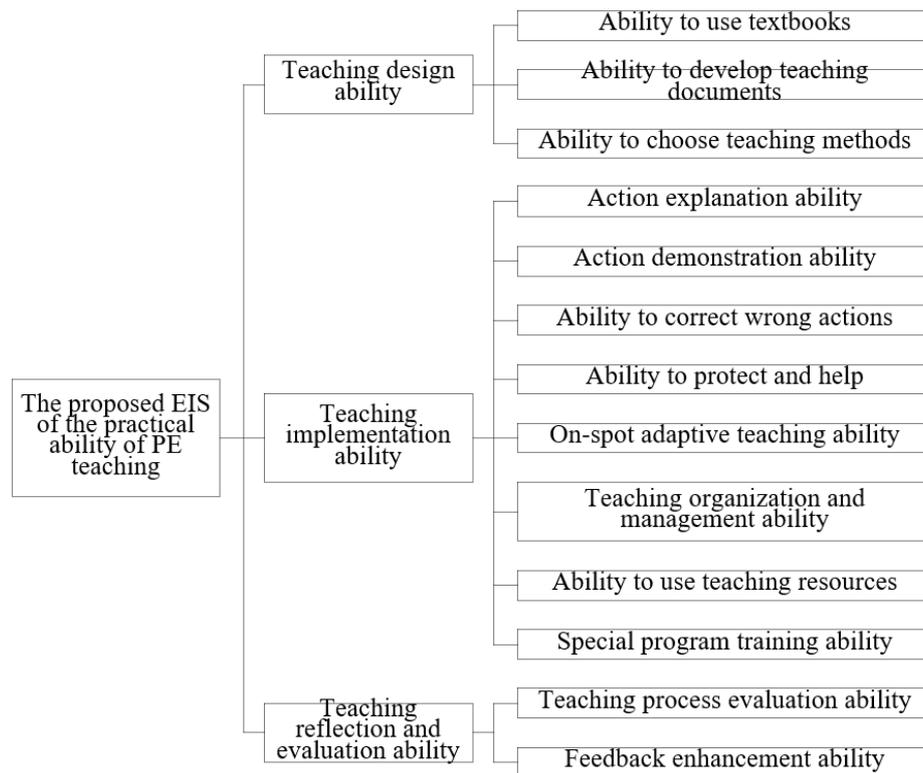


Fig. 11. The proposed EIS of the practical ability of PE teaching

4 Countermeasures to strengthen the cultivation of practical ability of PE teaching

As discussed above, now the shortcomings in the cultivation of the practical ability of PE teaching have affected the implementation of PE teaching activities, therefore, it's necessary to enforce countermeasures to strengthen the cultivation of practical ability of PE teaching. Figure 12 shows the proposed countermeasures to strengthen the cultivation of practical ability of PE teaching. At first, a correct cultivation concept should be established; during the cultivation of practical ability, PE teaching

ability shouldn't be taken as the only cultivation objective, the sports exercising ability, the sports game organization and management ability, and the sports health care ability should also be taken as the cultivation objectives. Second, the curriculum setting should be optimized; when setting curriculums for a discipline, time-efficient and comprehensive awareness are a necessity, teachers should teach students in accordance with their aptitude, trigger their learning motivation, and strengthen the cultivation of their versatility. Third, the classroom model should be optimized; multiple channels should be explored to develop students' thinking ability, creative ability, and practical operation ability; heuristic-style and explorative-style teaching methods should be applied more to comprehensively enhance the classroom teaching quality. Fourth, a sound education internship system should be established to appropriately increase opportunities and content of education internship, also, various content and diversified forms should be created for education internship activities. Fifth, a stable teaching practice base should be constructed for the purpose of cultivating students' professional practical ability, with this teaching practice base as the carrier, new modes of society-university cooperation could be promoted to closely integrate professional knowledge, skills, and practical teaching, so that the practical teaching for students could get closer to the requirements of social development. At last, the assessment and evaluation systems should be upgraded.

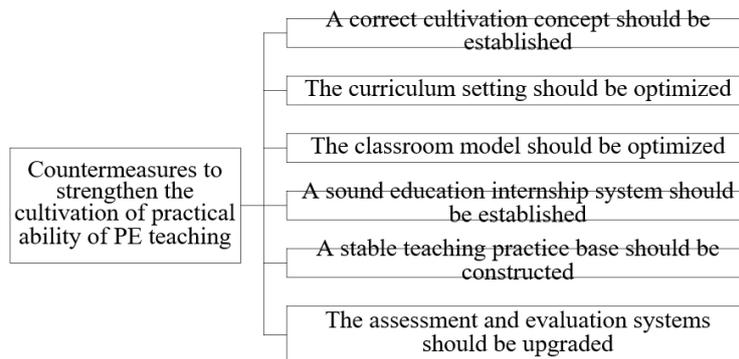


Fig. 12. Countermeasures to strengthen the cultivation of practical ability of PE teaching

5 Conclusions

Based on the classification and clustering algorithm, this paper clarified the current state of the cultivation of practical ability in college PE teaching, and obtained the following conclusions:

1. The social practical ability of PE teaching includes: activity organization ability, activity coaching ability, interpersonal communication ability, exercise prescription ability, and physical fitness evaluation ability. PE majors generally have a high satisfaction with their interpersonal communication ability.

2. In the self-evaluation of PE majors' practical ability, the communication ability won the highest score, followed by the learning ability, expression ability, and the team work ability.
3. The classification and clustering algorithm had been adopted to the comprehensive evaluation; the first-level indexes for assessing the practical ability of PE teaching include the teaching design ability, the teaching implementation ability, and the teaching reflection and evaluation ability.

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