Evaluation Model of Police Physical Education Teaching Mode Reform Effect based on IC3 Decision Tree Algorithm

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The existing evaluation model of police physical education teaching mode has the problem that the recursive attribute of data is not clear, which leads to a high degree of data dispersion. This paper designs an evaluation model to determine the effect of the reform of the teaching mode used for police physical education. The proposed model is based on the IC3 decision tree algorithm. In order to obtain information regarding the effectiveness of police P.E. teaching, we use a variety of teaching aids to achieve the teaching objectives, establish the evaluation index system of teaching mode reform effect, extract the recursive attribute of data based on IC3 decision tree algorithm, establish the branch structure according to the characteristic value, and set up the evaluation mode to determine the effect of reform. This is done by applying the cluster analysis algorithm, whereby the distance between data points and clustering is measured in order to construct the evaluation model. The experimental results show that the mean value of data dispersion in the evaluation model and the two existing evaluation models is 9.732%, 12.715% and 13.050% respectively, which indicates that the evaluation model integrated with IC3 decision tree algorithm has greater value in terms of practical application.

Keywords: IC3 decision tree algorithm, teaching mode, the effect of reform, evaluation model, police school, physical education teaching

1. INTRODUCTION

In China, the research on the police sector, considered professional, tends to be policy oriented, political and academic. There is little research on the mental and physical health of police. The comprehensive establishment and evaluation of police sports and competitive sports for the training and cultivation of a comprehensive range of police competencies is still relatively scarce. At present, the selection of police officers for this sector of the public service is still based on the exam results of the candidates. Admission to the police force tends to be granted to those with the highest academic scores. At present, local research on the subject tends to focus on police sports and the quality of instructors,

ignoring the overall improvement of the quality of the police persons themselves. In many western countries, entry into the police force is determined by a comprehensive set of standards that must be met. Standards have been established for physical stamina, psychological attributes, and general physical and mental health. However, in China, more attention is paid to the examination results, and the tests for physical stamina are not as rigorous [1].

In the new social environment, public security entities are called upon to undertake heavier tasks, and the number of malicious wrongdoings, gang crimes, violent crimes and unexpected major social crises are increasing significantly. According to annual statistics, in recent years, about 500 police officers have died and nearly 900 police officers have been injured on the job. A considerable number of them have been killed or injured because their poor physical fitness and

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inadequate police skills have made them powerless against criminals. Therefore, a police physical education curriculum must focus strongly on specific training objectives, and reflect the professional, and practical training required by public security professionals. Because of the range of environments within which the police must operate, and their indirect and direct engagements with criminals, the authorities tasked with police education and training need to improve the students' skills of capturing and fighting, cultivate their ability to engage in both independent and group combat, and create a group of qualified public security police who can catch up to, effectively fight, and capture criminals while effectively protecting themselves. For a long time, the teaching of physical fitness, capture and fighting, targeted shooting and other subjects in police physical education curricula has not been systematic, cohesive and consistent. This means that the police lack training in the physical aspects of policing which constitute the reality of public security work. Ultimately, students graduate with less-than-adequate physical skills and training. For example, the type of physical training given to police cadets is similar to that provided by ordinary colleges and universities. Hence, actual combat skills are poor, and the teaching content of each subject also lack an organic combination of teaching training, which means the course content needs to be reviewed and teachers should be better trained to meet the workplace needs of students. The reasons are not only the lack of appropriate facilities and equipment, but also the lack of appropriately-skilled teachers, and the gap in our theoretical understanding. Therefore, it is necessary to evaluate the reform of the teaching mode used for the physical education of police, and draw a conclusion.

2. MODEL BASED ON IC3 DECISION TREE ALGORITHM FOR EVALUATING THE OUTCOMES OF A REFORMED TEACHING MODE FOR POLICE PHYSICAL EDUCATION

2.1 Obtaining the Information Gain Parameters of Police Physical Education

There are several problems related to the physical education of police, as the outcomes of their education and training are inadequate. Currently, the training does not give police all the physical skills required to meet social needs. Hence, the quality of police higher education needs to be improved by means of reform, which in turn will affect the quality of policing. The teaching mode implemented in police physical education should be independent, stable, flexible, and of a high standard. The correct choice and application can make the teaching activities follow the law, which means that teachers should have clear guidelines. In order to achieve the training objectives and cultivate innovative talents in police physical education, we must change the traditional teaching mode of police physical education, which focuses only on developing the academic skills of the students, and establish a teaching approach that considers the main needs

of students and takes into account their cognitive, physical and mental development. Therefore, in order to reform the physical education pedagogy, the following points should be considered: the diversification of teaching objectives and teaching ideas should be reflected in the course content, which should be diverse and detailed. The teaching objectives should inform the physical education teaching approach, which greatly affects the activities of physical education teaching [2, 3]. Therefore, we should choose the physical education teaching approach according to the teaching objectives. The teaching approach must take two factors into account: the first is the availability of physical things such as various sports venues and the police academy's sports equipment. Some teaching methods comprise different combinations, such as sports items, teaching equipment and instruments. We should choose suitable sports venues and sports equipment according to specific teaching objectives, topics, and course content, and make appropriate arrangements for class venues. Therefore, when choosing a teaching mode, we should consider not only the needs of police cadets;, but also the specific needs and characteristics of police school instructors [4–6]. Because there are differences in the educational background, knowledge structure, teaching ability and teaching style of instructors, they should choose the teaching mode that is best suited to their own level of ability and current situation. However, instructors should strive to constantly improve their teaching skills and practices, keep up teaching reform trends, explore a variety of learning and teaching practices, experiment with various teaching models, rand use an appropriate physical education teaching model. Based on the known data on the effect of a reformed physical education teaching mode, the entropy value of information gain is obtained with Formula (1):

$$Q = \sum_{i=1} l \cdot e_i \qquad (1)$$

In Formula (1), l represents the number of courses after the reform of police physical education teaching mode, represents the logical level, and i represents the data node.

From the results obtained with Formula (1), the information gain parameters are obtained, and the evaluation is carried out combined with the teaching mode. With the heuristic teaching mode, police cadets have mastered the theoretical knowledge of certain sports, have certain sports ability and experience, and have some comprehension ability. Instructors need to have rich teaching experience, be good at implementing appropriate teaching methods and a flexible approach to guide students to think, although this may require more class time, which in turn requires more teaching hours. The teaching and learning outcomes are reflected by the students' mastery of certain skills, and their greater enthusiasm for learning and taking initiatives. The group teaching mode requires instructors to group students according to their individual differences, and adopt teaching methods that take into account the students' preferred learning styles. This requires instructors to be flexible and have a comprehensive range of teaching strategies [7]. Police academies need to have appropriate training venues and adequate equipment. The learning outcomes are reflected in the improvement of students' technical ability, analysis and problem-solving

skills. Students need to be able to adapt to changing social conditions, and they need to be encouraged to take a greater interest in sports and the purpose of learning. In the procedural teaching mode, the instructor should make clear the teaching contents and objectives, which can effectively control the learning process. To make the most of teaching and learning time, and improve the quality of teaching, the "three independent" teaching modes should enable teaching staff to adopt modern teaching approaches and develop a variety of curriculum resources. Moreover, and the police academy's sports teaching resources (instructors, venues, equipment, etc.) should be adequate to meet the teaching requirements [8]. The effect of a successful teaching and learning approach is reflected in the improvement of students' sports competency, the police cadets' mastery of a greater number of sports skills, and the students' level of cooperation and competitiveness.

2.2   Establishing the Evaluation Index System of Teaching Mode Reform Effect

A comprehensive set of indicators should cover the objectives and requirements of the evaluated reform projects and reflect the basic elements of the reform of the physical education teaching mode. Both obvious factors and invisible potential factors should be considered. There are many indexes used to evaluate the effect of the reform of physical education teaching mode. If all these indexes are listed, the evaluation index system would be very large and impractical. Also, some indicators are strongly correlated, so an analysis is required to identify specific problems and the major factors involved in order to determine the quality of the reform project being evaluated, which avoids using a complicated index system. The ultimate goal of establishing the index system is to obtain an accurate evaluation of the effects of reform. In order for the evaluation to be implemented effectively, it must have strong operability [9, 10]. The selected indicators must be suitable for statistical representation, analysis and comparison, as the basis for a comprehensive evaluation. The specific evaluation index should be determined according to the characteristics of the project and the reform objectives. Based on the literature review and the reform objectives of the instructor reform project in the disaster area, this study develops a corresponding evaluation index system for each evaluation link in the reform evaluation model. A reform demand index is used to understand the instructor's demand for reform and prepare for the design of a reform project. The contents include the instructor's call for reform, reform arrangements and reform contents [11–13]. For specific contents, please refer to behavior improvement level and performance achievement level. It includes the feasibility of the target, the rationality of the scheme, the potential degree of success, the reform effect, the demand for resources and funds [14, 15]. The indicators in this layer investigate the trainees' views and feelings about the effect of the reform, that is, their cognitive and emotional attitudes, which relates to their satisfaction with the project, the evaluation of the effect of the reformed curriculum, the effect of the reform on the lecturer, the effect of the reform arrangement, the effect of the reform method and so on. The purpose is to understand the students' attitudes towards and feelings about the effects of reform in time, timely discover the problems associated with the reform, address the issue of teaching reform, and constantly improve the reform outcomes.

2.3   Extracting Recursive Attributes of Data Based on IC3 Decision Tree Algorithm

IC3 is a decision tree classification algorithm based on information entropy, which selects the category of instance according to the value of an attribute set. The core function of the IC 3 algorithm is to select attributes at all levels of nodes in the decision tree, so that after the attribute divides the sample set into subsets, its entropy value is the minimum [16,17]. Using Formula (1), the information gain parameters are converted into the parameters of the additive optimization method, so that when the decision tree is generated, a small number of data tuples will not be submerged or the attributes with more and less important attribute values will not be reduced. Finally, the decision tree will reduce the dependence on attributes with more values, so as to reduce as much as possible the phenomenon of big data overwhelming small data. The optimized Formula (1) is changed to Formula (2):

$$Q(A) = \sum_{j=1}^{c} (e + 1) \times j \qquad (2)$$

In Formula (2), e represents the logical level, j represents the data length, and c represents the leaf node of the decision tree. It is expected that the average path of the non-leaf node to the next leaf node is the shortest, which makes the average depth of the generated decision tree smaller and improves the classification speed and accuracy. Even so, we still hope to have a large training instance set, because the larger the training set is, the more information will be obtained about classification. At this time, we can predict the classification of unknown instances by randomly selecting a hypothesis set consistent with the training set. However, if the training instance set is very small compared with the whole hypothesis space, but there are still too many hypotheses consistent with the training instance for us to choose, then the ability of making hypothesis generalization will be very poor. There are great differences between types of sports events and teaching and training practices in police academy and those in mainstream colleges, which is the reason for the high incidence of sports injuries. Police academy sports training has a strong antagonism content, and the curriculum contains a wealth of antagonism-related items, such as capture and fighting, tactical drills, arrest skills, etc. The movement process shows obvious antagonism characteristics, so the data of physical education teaching reform also has a recursive attribute. The formula for recursive attribute distribution is Formula (3):

$$T = -\sum_{m-1}^{n} g \times k_m \qquad (3)$$

In Formula (3), m represents the number of data attribute labels, n represents data tuples, k represents data feature vectors, and g represents the weight of reform effect indicators. Collecting the comprehensive data of students in the physical education curriculum is an important part of building the evaluation model to determine the effect of reform. The data should include injuries sustained by cadets, the actual effect of a particular exercise, and the impact of the reform of physical education teaching mode [18,19]. The rules regarding confrontation are very flexible. The purpose of police cadets' practical training is to enable them to fight violent criminals, and the training course lacks any clear rules for such confrontation. Police cadets should focus on improving the effectiveness of their skills. The teaching and training of "close to the actual combat" requires police officers to seize the opportunity in the confrontation and strive to defeat the enemy by one move. Therefore, it is difficult to control the strength of the actual combat drill and it is easy to cause damage. The training curriculum and special training given at the police academy lack scientific guidance, rely too much on experience, focus on strengthening the dominant side of the body, and ignore the weak side. For example, in target shooting training, the muscle stability training of the arm on the gun side is greater, resulting in an imbalance of the upper limb strength of both sides. In other training, the weak side is prone to compensatory action, which will destroy the effectiveness of the action and poses the potential risk of injury. Police cadets have more weight-bearing exercises when training, which leads to greater pressure on the core area of the body and makes this area prone to injury. For example, police cadets need to carry police equipment in actual combat training, or they need to carry police equipment in endurance training, which increases the load on the neck, shoulder, lumbar and knee joints. For the design of a P.E. course, IC3 decision tree algorithm verifies all features, selects the feature attribute with maximum information gain to generate decision tree nodes, establishes branches from different values of the feature, recurses the instance subsets of each branch, and uses this method to establish decision tree nodes and branches until the instances in a subset belong to the same class. During decision tree learning, one of a set of hypotheses must be selected to match the training set. If it is known in advance that the function to be learned belongs to a small subset of the whole hypothesis space, it is possible to learn useful hypotheses from the training set even if the training set is incomplete, so that it can correctly classify the unknown instances.

2.4 Cluster analysis algorithm setting reform effect evaluation mode

The purpose of clustering is to group the sample data into a certain number of categories, so that the similarity between the nodes within a cluster is high, and the node difference between the clusters is large. We should strengthen the training of students' pursuit ability and fighting skills, and combine them with education, so as to improve their stamina, courage and persistence. The physical ability course is intended to cultivate students' pursuit ability by changing the original teaching content of 1500 m and 800 m for women to 5000 m for men and 3000 m for women. The original events of men's (women's) 100 m hurdle race and 110 m hurdle race were changed to 400 m hurdle race and 400 m hurdle race, and 5000 m and 3000 m hurdle race were required in each academic year. The teaching of target shooting changed from the past 25 m fixed static position, to various positions including standing, kneeling, lying and other dynamic movements. The shooting target changed from being static to being a hidden or moving target. Also, focus was placed on accuracy to prepare police for any number of unexpected situations. The distance from node to class was measured using Formula (4) distance formula:

$$D = \frac{1}{|h|} \sum_{h \in p} y_h \qquad (4)$$

In Formula (4), h represents any cluster, p represents specific data points, and y represents clustering distance. According to the calculated results, a distance from the point to the cluster is obtained, and then the points are divided into the classes with the minimum average damping distance. The teaching and training of capture and grappling focuses on improving students' actual combat ability and cultivating their ability to subdue criminals and prevent harm to themselves and their colleagues. Actual combat training is the main focus, where organized Boxing (first grade), Sanda (second grade) competitions simulate the actual combat situation make the students be personally on the scene, the course of "Investigation and Arrest Tactics" has been added. Hence, the police training course includes physical fitness, capture and fighting, targeted shooting, and arrest skills. Taking the lead in carrying out comprehensive exercises in public security colleges and universities all over the country with camping training, round up, hostage rescue and blocking as the main content, students' stamina, work ethic, courage, persistence, and morality have been developed and improved. Methods are implemented the measures, which refers to take the method of promoting the middle, focus on organizing the extracurricular teaching training of students with weak physical ability, and actively cultivate their self the training ability. Tests should be conducted regularly to achieve a combination of in-class teaching and extracurricular activities, group practice and conscious exercise. In order to ensure the students' one-hour police physical exercise time every day, the school adjusted the class time, and timetabled the morning exercises and extracurricular exercises as the police physical education teaching time. We should foster the enthusiasm of the police sports instructors and student management entities, advocate the spirit of dedication, implement the examination of teaching separation, and use the weekend to establish a time and organize the examination, so as to reduce the influence of the instructors' subjective factors and make the examination of police physical education standardized and scientific. With the increase of grade, faced with the influence of graduation allocation and the reduction of physical class hours and other factors, it often appears that the higher the grade, the lower the students' physical quality, especially the endurance quality [20–22]. Combined with the reality of public security, police

Table 1 Dataset parameters.

Data set number	Number of nodes	Number of adjacent edges	Maximum number of branch nodes	Maximum number of adjacent edges of a branch
1	606	1406	136	931
2	488	1966	142	647
3	367	1842	151	688
4	268	3109	179	1064
5	522	2544	166	834
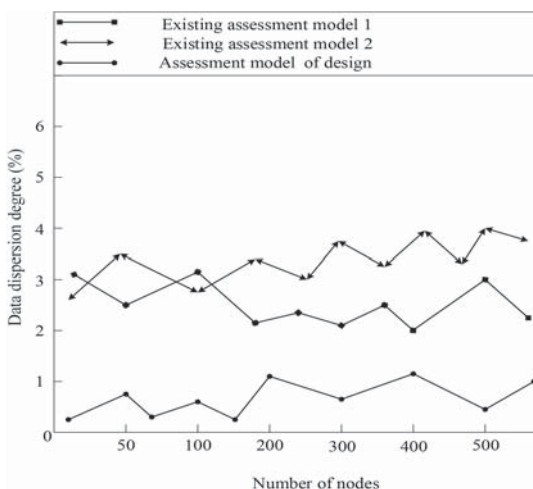
Figure 1 Data discreteness when the number of nodes is 500.

physical education consciously focuses on strengthening the teaching and training of students' pursuit skills. According to the statistical results, apart from the 3000 m score of the first-grade girls being higher than that of the second and third grade girls, the other grades improved with the increase in level. However, according to the statistics for 1000 m and 800 m average scores of male and female students in the first, second and third grades of the three senior district teams, the average score of the second grade is lower than that of the first grade, but the endurance quality training is strengthened in the third grade, and the average score is significantly improved. It is a major reform in the structure and teaching mode of P.E. curriculum in a police academy as it strengthens the students' concept of police physical education, carry out individual police persons comprehensive training and comprehensive camping exercises, takes male 5000 m and female 3000 m as the required training items in each academic year, and separates examination from teaching. In order to determine the effectiveness of the teaching reform, we conducted a survey of examining 23 physical education courses for police for students of three grades, to fully understand the students' views on the reform of police physical education in schools. The results show that 78.3% of the students in the three grades think it is necessary, and only 21.7% think it is unnecessary. The students' understanding of endurance quality (CS 1000 m/3000 m) and 400 m obstacle training also increased when they progressed to the next grade; in particular, 54.3% and 56.6% of junior students thought it necessary. This is because senior students, by being involved in the front line of public security, have a greater understanding of the importance of police having a strong physique. However, some students think that the comprehensive camping exercise is dispensable and unnecessary, which is basically consistent with their reluctance to accept an innovative teaching approach.

3. EXPERIMENTAL ANALYSIS

3.1 Setting Dataset Parameters

In the evaluation model, each line of the text document indicates that there are two connected network nodes, and a space is used to separate the two node names. For the purposes of the experimental test, parameters are established for the dataset. These are shown in Table 1 below.

3.2 Experimental Results

In the experiment, the evaluation models used to determine the effect of the reformed teaching mode based on damping distance are: model 1 which is the existing evaluation model, and model 2 which is the evaluation model used to determine the outcome of teaching mode reform based on fuzzy set theory. The degree of data dispersion in the three evaluation models was tested using different node numbers. The lower the value, the better is the result achieved by the applied model. The experimental results are shown in Figures 1–3.

As can be seen from Figure 1, the mean value of data dispersion in the evaluation model and the two existing evaluation models is 1.368%, 3.142% and 3.575% respectively. Figure 2 shows that the mean value of data dispersion in the evaluation model and the two existing evaluation models is 11.491%,
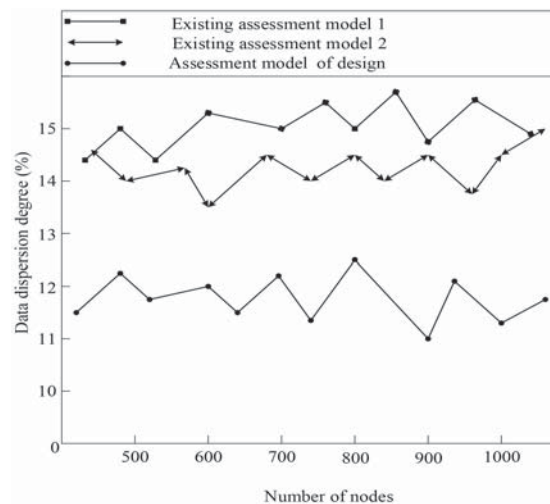
Figure 2 Data discreteness when the number of nodes is 1000.
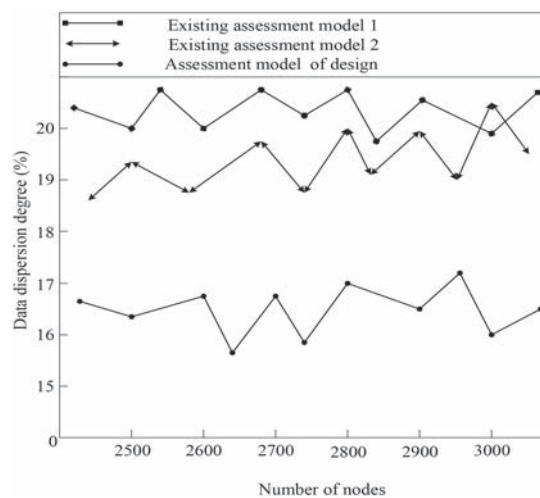

Figure 3 Data discreteness when the number of nodes is 3000.

15.336% and 14.463% respectively; As shown in Figure 3, the average value of data dispersion in the evaluation model and the two existing evaluation models is 16.339%, 19.667% and 21.113% respectively, which proves that the evaluation model designed in this paper has better performance in terms of practical application.

4.   CONCLUSION

Based on the actual needs of police physical education, this paper constructs an evaluation model to determine the effect of teaching reform, which enriches the academic literature on IC3 decision tree algorithm, and the reform of the teaching mode used police physical education At the same time, it offers new directions for future related research which could improve the practical feasibility. Due to the limited research conditions, the application research of IC3 decision tree algorithm in other fields is not thorough enough, and will be improved in the future.

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