Practice of PE Teaching Reform in Colleges and Universities Under the Background of Multimedia Internet

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ABSTRACT
Multimedia network technology refers to multimedia network teaching based on text data communication, which can make better use of sports resources in college physical education teaching. Multimedia technology combines computer and video technology. It refers to the combination of two or more sounds and images to form a system that can transmit information. When the initial key changes slightly, the hash bit change rate of the scheme is greater than the threshold value of 0.451, which shows that the hash algorithm in this paper has good key sensitivity. The more sensitive the perceived hash is to the change of the key, the more difficult it is for the attacker to estimate the key, and the better the security of the hash key. Therefore, the above experiments can prove that the hash algorithm in this paper is safe. The appearance of sports network distance education in this paper provides a broader stage for schools and makes greater contributions to the improvement of the overall physical quality of citizens in the whole society.

KEYWORDS
Multimedia Network Teaching, Perceptual Hashing, Physical Education, Platform Design

INTRODUCTION
The rapid development and transformation of informatization has made multimedia information technology and network technology popularized rapidly around the world (Cheng, 2021). This modern technology not only affects people’s lives, but it also has an infiltrating role in promoting the development and reform of education, especially for colleges and universities. With the rapid development and popularization of the Internet today, the use of the Internet to transmit multimedia streams with high bandwidth requirements has become increasingly popular (Da-Wei et al., 2018). As far as the field is concerned, the shock to traditional educational concepts, teaching models, and educational technology is unprecedented (Yang, 2017). Especially in recent years, with the popularization of the Internet, network education and multimedia technology have been continuously developed. Applying multimedia technology to network education has become a popular topic for educators to study by realizing the publishing and sharing of multimedia courseware and the dynamic integration of multimedia courseware materials.

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Because the multimedia computer can display all kinds of information such as pictures, texts, and sounds in front of students, it has the characteristics of intuition, image, and vividness and can provide the most ideal teaching environment (Bailey & Macfadyen, 2002). Compared with traditional teaching methods, the multimedia network teaching system has the following advantages: good teaching environment and teaching and listening are not easy to be disturbed. The teaching methods are flexible and diverse, which can realize a series of functions such as randomly grouping discussion, roll call, multiple-choice question answering, etc. Using modern network technology, people can share a variety of media, such as sound, music, words, images, etc. and reduce time waste; teaching space is not limited, and teaching activities cannot be limited to one classroom, but they also make distance education possible (Calderón-Garrido & Gil-Fernández, 2023). However, it is also important to note that multimedia education may lead to students falling into the dilemma of excessive use of electronic devices, and this will result in distracted attention. Students only browse and digest information superficially, rather than thinking and understanding deeply, resulting in insufficient mastery of their physical health and academic performance. Therefore, when using multimedia technology for education, it is necessary to balance its advantages and disadvantages and take measures to ensure that students can effectively utilize these technologies, rather than relying excessively on them, in order to avoid adverse effects on learning and development.

The multimedia network teaching platform provides a powerful information database for college students, which contains the latest global sports information, the most detailed technical action essentials, and the most intuitive sports videos (Wang, 2015). Through interactive use, professional coaches and experts can give “close-fitting” guidance (Duan & Yang, 2015). From the practical value, it guides practice through theory, applies multimedia teaching to classroom teaching deeply, promotes classroom teaching reform, and greatly improves teaching quality.

The innovation points of this article are:

1. This paper has conducted an in-depth and detailed investigation and analysis of multimedia in the way of physical education teaching processes about jump teaching, and it puts forward practical and effective methods for the mode change of physical education from the theoretical and practical perspectives to integrate multimedia teaching into physical education and improve the education level comprehensively.

2. This article innovatively constructs a hash perception model and proposes a hash scheme that uses jitter quantization to extract image features and scramble the feature matrix. In addition, in the process of multiple feature extraction, using different keys to extract features will further increase the security of feature extraction. Further analysis confirms the security of the hash algorithm. Finally, in order to test the performance of the proposed scheme, the authors creatively build a video copy detection experimental platform and refer to the evaluation standards of the platform.

3. This article provides an in-depth analysis of the widespread application of multimedia teaching, effectively managing the unified planning of subject teaching modes, forming regular approaches and methods, greatly improving the quality of actual teaching, and stimulating students’ learning enthusiasm.

This paper examines the research problem of building a theoretical platform for physical education in colleges and universities and is structured as follows.

The first section is the introductory part. This part mainly elaborates the background and research significance of the research on the construction of the college physical education teaching theory platform from the perspective of the multimedia network and puts forward the research purpose, method, and innovation of this paper. The second section is mainly a review of related literature, summarizing the advantages and shortcomings of it and putting forward the research ideas of this
paper. The third section is the method section, focusing on the research design method of combining the multimedia network and college physical education teaching theory platform building. The fourth section is the experimental analysis part. This part conducts experimental validation in the data set to analyze the performance of the model. The last section is the conclusion and outlook. This part mainly reviews the main contents and results of this paper, summarizes the research conclusions, and points out the direction of further research.

**RELATED WORK**

Multimedia teaching has begun to evolve into an important tool in the advance of educational activities. The advance of modern online education has become a global trend (YIN & ZHOU, 2015). In response to this phenomenon, relevant experts and scholars have discussed and studied the application of multimedia in education and formed a lot of theoretical knowledge and viewpoints. The rich theoretical foundation has also been widely verified in practical applications. This article uses academic databases and literature retrieval tools to capture literature related to the topic through keywords and phrases. Then, preliminary screening is conducted based on the relevance of the title and abstract to exclude literature unrelated to the research topic. The remaining literature is then read in full, and relevant information is summarized as follows.

Goldman and Waxman pointed out that the arrival of the information age is affecting the disseminators and teachers as well as the behavior of teaching and learning (Perczel & Császár, 2002). For education, information technology is an information resource, curriculum field, communication medium, perspective tool, booth, etc. Chen Xiaoping and Jia Jun made a detailed exposition of the basic characteristics of network teaching and the significance of physical education network teaching in colleges and universities by using the method of literature and materials, the method of investigation, the method of comparison, and the method of expert consultation and found and pointed out the multimedia network teaching (Kratzer, 2018). Irfa and Zen Fadl believe that technological development and changes in globalization towards the digital age are challenges that must be balanced with the learning process in order to enhance university education and improve learning efficiency; the development of multimedia learning products will facilitate teachers and students in the classroom (Deng, 2021). Antoniou Panagiotis believes that for more than two decades, computers have been used by teachers and coaches at all levels of education and physical training as an auxiliary tool for providing information (Ye et al., 2021). In many educational programs, computers are not only used as an educational tool, but are also used as an active part in the educational process. Guo Ruibo explored the application of multimedia technology to high school biology teaching (Chen & Ennis, 2004). The conclusion shows that multimedia teaching has obvious advantages. Using this method in high school biology teaching can stimulate students’ enthusiasm and initiative in learning and improve students’ learning and thinking ability. Liu Li analyzed the advantages and strategies of multimedia teaching in sports (Liu, 2019). The article summarized several advantages of sports multimedia teaching, such as being conducive to shaping students’ character, cultivating students’ self-motivation, developing students’ intelligence, cultivating students’ creativity, and improving teaching efficiency. Li Xianjian analyzed the characteristics of multimedia technology applied to physical education in colleges and universities. From this article, the authors can see that multimedia teaching is characterized by strong interaction, vividness, and speed (Al-Oun, 2015).

In the context of the increasing popularity of high-speed Internet in modern society, it is widely used in education, books, consulting and services, communications, medical treatment, finance, military, and other industries and further promotes the development of science and technology.
METHODOLOGY

Unary Gaussian Distribution

The content contained in a teaching component for learners to learn is obviously the main body of courseware resources. In order to make it easier for learners to accept and understand knowledge, courseware makers often use multimedia for teaching. The layout of multimedia information in the display area and the synchronization of multimedia materials in time during courseware playing play an important role in the quality of courseware production (Lin et al., 2018).

The authors start with the simplest and most common univariate Gaussian distribution, whose probability density function is:

\[
p(x) = \frac{1}{\sigma \sqrt{2\pi}} \exp\left(-\frac{(x - \mu)^2}{2\sigma^2}\right)
\]

(1)

where \(\mu\) and \(\sigma\) denote the mean and variance, respectively; and this probability density function curve is drawn as the familiar bell-shaped curve, with the mean and variance uniquely determining the shape of the curve. If the authors take measurements at an infinite number of time points each day, it becomes the case of Figure 1. Note that by using the measurement time as the horizontal axis in the figure below, a line in each color represents an (infinite number of time points of measurement) infinite dimensional sample. When sampling an infinite dimension to get an infinite number of points, it can actually be understood as sampling a function.

Kernel function is the core of a Gaussian process, which determines the nature of a Gaussian process. The function of kernel in a Gaussian process is to generate a covariance matrix (correlation coefficient matrix) to measure the “distance” between any two points. The most commonly used kernel function is the Gaussian kernel function, which also becomes radial basis function RBF. Its basic form is as follows. Where \(\sigma\) and \(l\) are superparameters of Gaussian kernel:

\[
K(x_i, x_j) = \sigma^2 \exp\left(-\frac{||x_i - x_j||^2}{2l^2}\right)
\]

(2)

Figure 1. Function sampling diagram
Multivariate Normal Distribution

The definition of the probability density function of a multivariate normal distribution is:

$$
\rho(x) = \frac{1}{(2\pi)^{d/2} |\Sigma|^{1/2}} e^{-\frac{1}{2}(x-\mu)^T \Sigma^{-1} (x-\mu)}
$$

(3)

Obviously, when \(d=1\), multivariate Gaussian is consistent with univariate Gaussian. Sometimes the symbol \(N(\mu, \Sigma)\) is used to represent the Gaussian probability density function with the mean value of \(\mu\) and the covariance of \(\Sigma\).

In order to better understand what multivariate Gaussian is, the authors consider some cases in two-dimensional space, which is visible. In this case, there are:

$$
\sum [\sigma_i^2]
$$

(4)

Perceptual Hash Construction Model

Before feature extraction, the most perceptually meaningful feature parameters are selected by removing the perceptual redundancy through various signal processing methods. In order to facilitate hardware implementation and reduce storage requirements, post-processing such as quantization and coding of these feature parameters is also required (Wang, 2016). After extracting the perceptual features, the perceptual features are compressed and the final perceptual hash code is output. The multimedia authentication scheme based on perceptual hash is shown in Figure 2.

Figure 2. Perceptual hash authentication
The authentication process is as follows: the sender extracts the perceptual hash from the multimedia signal as the authentication information and transmits the multimedia signal and the authentication hash code to the receiver. The receiver performs hash calculation on the received authentication signal at the receiving end to generate a verification-aware hash code. By comparing the authentication hash code and the verification hash code, the receiver can judge whether the content of the authentication object has been tampered with and determine the authenticity of the content, as seen in Figure 2.

The authentication hash generator authenticates the object \( I \), and the security of the hash is guaranteed by the key \( k \), and the authentication hash code is obtained. The construction algorithm can be conveyed as the following formula:

\[
v = H(I, k)
\]  

At present, most of the existing perceptual hash authentication schemes use a single feature to generate hash (Yang, 2019). It is difficult for a single feature with little content to meet the performance requirements of perceptual hash authentication. Next, taking digital images as an example, the relationship between feature selection and authentication performance is analyzed, and the corresponding feature selection strategy is proposed (Ma, 2017).

The authentication result obtains the multimedia authentication result by calculating the difference between the authentication hash and the detection hash code \( m \):

\[
m = D(v, \hat{v})
\]  

In the existing perceptual hash authentication scheme, the bit length of hash code is arbitrarily chosen, and it is often directly combined into hash code according to the number of extracted features, without considering the amount of content information. In this paper, it is proposed that the authentication-aware hash can be generated by adopting the multi-resolution structure construction method that transits from the region of interest to the general region.

Given a perceptual hash code of multimedia object, it is difficult to deduce the original object; that is, the generation process of perceptual hash is irreversible. For a given closed value, the probability of calculating the original object by using the perceptual hash code should satisfy:

\[
P(H(I, K) = v) \approx \frac{1}{2^n} << 1
\]  

To facilitate the analysis of the accuracy of the authentication system, the concept of perceptual hash authentication space is introduced in this paper. In authentication, the perceptual hash function is considered as a mapping from multimedia space to perceptual hash space, which can be expressed as:

\[
H : M \times K \rightarrow C
\]  

Usually, a variety of features can be extracted for multimedia content for constructing hashes, and these features can cover the information of the content to different degrees and have different degrees of change response to multimedia content changes. The selection of different features has different effects on the performance of the authentication hash, and the features that can accurately reflect the changes in multimedia content will construct a perceptual hash with better performance (Nazir, 2019). Define the perceived change correlation of features to content \( S_e \):
\[ S_e = \frac{En(P + \Delta P) - En(P)}{\Delta P} = \frac{\Delta X}{\Delta P} \] (9)

In the construction of authentication-aware hash, the compression process also directly affects the hash-aware performance, and the stronger the compression, the worse the generated hash responds to the change of multimedia content (Cheng et al., 2022). The impact of the compression process on the perceptual hash response to multimedia content can be defined as the compression perception correlation degree \( S_d \):

\[ S_d = \frac{De(Z + \Delta Z) - De(Z)}{\Delta Z} = \frac{\Delta C}{\Delta Z} \] (10)

RESULT ANALYSIS AND DISCUSSION

The hash scheme proposed in this paper uses dither quantization to extract image features and scramble the feature matrix. The jitter matrix generated by the chaotic map is extremely sensitive to the initial key, and a small change in the initial key will lead to huge differences in the generated pseudo-random sequences. In addition, in the process of multi-feature extraction, if different keys are used to extract features, the exhaustive space of the initial key, that is, the security of feature extraction, will be further increased (Zhou, 2016). In order to test the security of the hash algorithm proposed in this paper, 114 images were selected to conduct the algorithm security experiment, as shown in Figure 3.

As shown in Figure 3, when the initial key is slightly changed, the hash bit change rate is greater than the threshold value of 0.451, which shows that the hash algorithm in this paper has good key sensitivity. The higher the sensitivity of the hash function to key changes, the harder it becomes for attackers to crack the key, thereby improving the security of the hash key. Therefore, the above experiments can prove that the hash algorithm in this paper has good security.

When you look at an image, you usually see areas with connected textures and similar gray levels, which combine to form objects. In this paper, the tree structure is used to decompose the image according to the complexity of the image texture, extract the features of different resolutions,
and construct the authentication hash. Non-similar regions with small object size or low contrast are recursively decomposed, and features are extracted with higher resolution, while features are extracted with lower resolution for regions with large object size or strong contrast (Zhang et al., 2021). Finally, each resolution feature is compressed and combined to generate the authentication hash.

The ROC curve is a commonly used indicator for evaluating machine learning models. The vertical axis represents the ‘True Positive Rate,’ and the horizontal axis represents the ‘False Positive Rate.’ The closer the ROC curve is to the upper left corner, the higher the recall of the model is. The point on the ROC curve closest to the upper left corner has the lowest total number of false positive and false negative examples, which is the threshold for minimizing classification errors. The authentication scheme with small false alarm rate has the best authentication performance, and the scheme near the upper left corner of the graph is the one with the lowest false alarm rate and false alarm rate. It can be seen from the graph that the perceptual hash scheme proposed in this paper has better authentication performance, as seen in Figure 4.

It has been proven that selecting multiple features with more image content and complementarity can achieve better authentication performance. In order to test the performance of the proposed scheme, this article has built a video copy detection experimental platform and referred to the evaluation standards of the platform. The video sequences are randomly extracted from the video database, and the attack method is randomly selected from the set of attacks for processing, and finally the video sequences are randomly inserted into a data stream consisting of video segments not contained in the video database to form a video copy test sample (Yun & Worapongpat, 2023).

Interest is the best teacher, so whether students have interest in learning sports or not has a very great impact on their performance. In order to effectively verify the impact of the multimedia learning mode on students’ interest, Table 1 shows the statistics based on the relevant data from the questionnaire.

It can be seen from Table 1 that the college students in the experimental group are significantly more interested in learning sports than those in the control group. Sports have relatively high requirements for technical movements. It can also be seen from Table 1 that the college students in the control group who adopt the traditional teaching mode basically belong to the passive learning subject and lack the corresponding interaction and learning experience, so the college students’ learning interest is difficult to cultivate and lacks the initiative of learning. College students should

Figure 4. The ROC curve of this paper’s solution and other solutions
not only learn under the active guidance of teachers, but also have an active learning spirit. Only through the effective combination of both sides can they effectively improve their learning results.

After the experimental teaching, Table 2 makes a statistical analysis on the teaching effect of the college students in the experimental group who adopted the multimedia teaching mode and the college students in the control group who adopted the established traditional teaching mode.

It can be seen from Table 2 that the average score of the students in the experimental group exceeded 84 points, while the average score of the students in the control group was lower than 78 points. According to statistical software, P<0.1 indicates that this difference is unlikely to be accidental, so there is significant statistical significance between the two groups. This fully demonstrates that using multimedia teaching mode is more helpful in helping students absorb knowledge. This teaching method pays more attention to the combination of class and after class, pays attention to students’ independent exploration and research, and pays attention to self-demonstration and explanation in class, which also plays a very good role in promoting students’ awareness of daring to do and speak. Through multimedia teaching, students can experience their daily activities as teachers in concrete practice, which is conducive to improving students’ practical ability.

The traditional sequential copy detection methods Order Matching (OM) and Transaction Order Matching (TOM) are techniques used to detect and prevent copy or replay attacks in concurrent database transactions (Häkkinen et al., 2017). They are typically applied in distributed database systems to ensure transaction consistency and security. The OM method focuses on detecting the execution order between concurrent transactions. The TOM method focuses on the data dependencies between transactions, not just the order of execution. OM is usually more suitable for lightweight and efficient environments, while TOM may be more suitable for monitoring the detailed data dependencies between transactions. In order to finally determine the identity of the detected copies accurately, the detection system must minimize the error detection rate while the detection rate is guaranteed. In the case of the same detection rate, the smaller the error detection rate of the system is, the better the detection performance will be.

Figure 5 gives a graph comparing the performance of the scheme in this paper with the traditional sequential copy detection methods OM and TOM. By observing Figure 5, it can be found that the system proposed in this paper has a lower false detection rate compared with other systems under the same detection rate, which means that the detection performance of the system is better.

Table 1. Comparative analysis of students’ learning interest between the experimental and control groups

<table>
<thead>
<tr>
<th></th>
<th>Very Interested</th>
<th>More Interested</th>
<th>General</th>
<th>Not Interested</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>114</td>
<td>514</td>
<td>191</td>
<td>81</td>
</tr>
<tr>
<td>%</td>
<td>12.6</td>
<td>57.1</td>
<td>21.2</td>
<td>9</td>
</tr>
<tr>
<td><strong>Control group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>97</td>
<td>441</td>
<td>269</td>
<td>93</td>
</tr>
<tr>
<td>%</td>
<td>10.8</td>
<td>49</td>
<td>29.9</td>
<td>10.3</td>
</tr>
</tbody>
</table>

Table 2. Comparative analysis of the teaching ability of students in the experimental and control groups in long jump

<table>
<thead>
<tr>
<th></th>
<th>Explanation</th>
<th>Demonstration</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental group</strong></td>
<td>86.24</td>
<td>86.29</td>
<td>84.31</td>
</tr>
<tr>
<td><strong>Control group</strong></td>
<td>77.77</td>
<td>71.94</td>
<td>76.52</td>
</tr>
<tr>
<td>P</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
</tr>
</tbody>
</table>
In the video copy detection, the detector not only needs to detect all suspicious object frames or fragments, that is, have a good detection recall rate, but it also needs to detect the correct detection object in the detection results. The higher the ratio, the higher the precision. In the case of the same recall, the higher the detection precision of the system is, the better the detection performance will be.

By comparing Figure 6, the authors can see that when the recall rate is 87%, the precision rate of this scheme is 84.9%, while the precision rate of Tom scheme is 64.5%, and the precision rate of OM scheme is 61.32%. This shows that the detection performance of this scheme is better.

However, because the traditional frame block gray mean is still used to construct the sequencing feature, the neutral energy in detection is general. The scheme proposed in this paper adopts quantitative and statistical analysis methods to construct video sequencing features, which enhances the robustness and identification of features and calculates the similarity of features in the space-time domain at
the same time. Compared with the traditional sequencing detection scheme, this scheme has the best detection performance. How to further improve the performance of detection and find more robust sequencing features is the main research direction in the future.

CONCLUSION

The real multimedia network teaching platform is the downloading of materials; it also has strong multimedia teaching functions and interactive learning functions of real-time communication, and it can achieve the optimization and sharing of teaching resources, which are not available in the campus websites of traditional universities. The promotion of the multimedia teaching platform in physical education can not only complement the advantages of traditional physical education in colleges and universities, but also improve physical education in colleges and universities. When the initial key of the scheme changes slightly, the change rate of hash bits is greater than the threshold value of 0.451, which shows that the hash algorithm in this paper has good key sensitivity. The more sensitive the perceptual hash is to the key change, the more difficult it is for the attacker to estimate the key, and the better the security of the hash key is. Therefore, the above experiments can prove that the hash algorithm in this paper is safe. As a new technology of multimedia content management, hash technology is widely used, covering multimedia copyright protection, content authentication, copy tracking, and so on. Its scheme design focuses on the perceptual hash system with robustness, sensitivity, and security. However, due to the conflict between the performances of the three, it is necessary to make different forms of compromises on the performances of the three in different application occasions. University teachers should learn to create multimedia animations, summarize and process network information, participate in the webpage design of multimedia network teaching platforms, and develop sports network resources. This can improve the level of physical education teachers in using modern information technology, improve the online physical education information resource environment, improve the quality of physical education classroom teaching design, and provide support for the application of sports multimedia network teaching platforms.

DATA AVAILABILITY

The figures and tables used to support the findings of this study are included in the article.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

COMPETITIVE OF INTEREST

The authors declare that they do not have competitive interests.

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