Design of Comprehensive Rating Algorithm for Classroom Teaching Effect under the Background of Sports Education Integration

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Exploring the improvement of classroom teaching effect under the background of sports education integration in China has important practical significance and theoretical value. Integration of yard sports education and classroom course education in the school is a novel concept put forward by China’s sports and education circles to deepen the combination of sports and education. Although it is only a word different from the combination of sports and education to integrating sports and course education in the school, it is a groundbreaking theoretical and practical innovation for China in terms of changing the competitive sports development model and cultivating exceptional athletes. It is a new way to promote the sustainable development of sports and education according to the scientific outlook on development. Its fundamental significance is to change the closed state of sports and education departments, put sports and education in the background of economic and social development in a certain region, and fundamentally reform the content and mode of education. Therefore, this paper proposes a comprehensive rating model of classroom teaching effects based on deep learning (DL) and machine learning (ML) techniques. In this paper, the Jaffe expression dataset is used to train and test the utilized ML and DL models such as ResNet50, random forest (RF), logistic regression (LR), K-nearest neighbor (k-NN), and decision tree (DT). Further, with the help of artificial intelligence (AI) techniques, the algorithms can objectively evaluate the classroom teaching effect after the integration of physical education with classroom education and provide important guidance for the modernization and intellectualization of China’s educational methods in the future.

1. Introduction

Physical activity and sports combined with the school curriculum play an essential role in the accomplishment of a well-rounded education. For youngsters who are unable to attend school, sports provide lifetime learning and alternative education [1]. Physical education encourages youngsters to broaden their horizons by making it simpler to understand the principles of one sport while learning the regulations of another. Teenagers’ physical health and the development of reserve abilities in competitive sports have received a lot of attention in recent years. The State General Administration of Sports and the Ministry of Education recently announced joint comments on increasing the integration of sports and course education in the school and encouraging the healthy development of teens, outlining eight concrete ways to promote the level of integration of sports and course education in the school.

Physical education should be more than just a requirement; it should be implemented effectively with homework, examinations, and competitions. However, it may lead to some challenges and problems. Having physical education homework and increasing the proportion and role of physical education in students’ learning careers are bound to reduce the weight of cultural courses. Can it be implemented? This requires not only time but also practical solutions [2].

The combination of sports and education is not a new concept. As early as the 1980s, the concept of the combination of sports and education was once very popular.
However, over the years, the road to combining sports and education has been extremely difficult, and the effect is not very obvious. The recently proposed merging of sports and education techniques aims to help students in developing their physical and mental health and aims to strengthen school physical education. It has a different focus and emphasis from the previous combination of physical education and education [3–5]. Combining yard sports classes and classroom course education, as well as merging sports and course education in the school was traditionally associated with the development of reserve talents in competitive sports. Integrating sports and academic instruction in the school, as advocated this time, focuses on improving young pupils' physical activity. China’s school physical education was once in an embarrassing situation. The physique of teenagers in China has been declining for more than 20 years. The physical fitness test of college students conducted every year is more difficult for many students as some boys are unable to complete it. Many kids feel under pressure while running for 800 meters or 1000 meters.

Li Jianming, Deputy Director of the State Sports Administration, said that the integration of physical education and education is more than just a simple combination of resources from the two departments; it is also a shift in mindset. This idea should achieve the purpose of cultural people and sports persons to release the comprehensive function and value of physical education in educating people and play a more important role. Therefore, merging sports and course instruction in the school entails a comprehensive integration of physical education and education in terms of relevance, function, and purpose, all of which have an impact on teenagers’ development. The concept of mixing yard sports training with a classroom course is innovative, but there are health benefits first and foremost [6]. In China, all elementary and secondary schools must create a health-first educational philosophy. Physical education and education departments should carry out linkage, integrated design, unified promotion, and incorporated implementation in the teaching mechanism, educational philosophy, teaching conditions, and social participation of school physical education. At the same time, we also need to establish the important position of school sports. The sports department should get more involved in school sports and play a role in strengthening physical education, amateur training, and organizing sporting events. Furthermore, we should actively engage with society and the market, encourage more social organizations to assist teenagers in growing up healthy, and work to ensure that integrating sports and course teaching in the school produces the effect of “1 + 1 > 2.”

The main contributions of this article are as follows.

(i) This study focuses on leveraging DL and ML technology to build a real classroom teaching effect evaluation model and apply it to teaching practice. By evaluating the facial expression of the athletes, the outcome of the proposed model judges the impact of classroom teaching.

(ii) This study also compares and analyzes the effect of the classroom by utilizing different ML and DL models such as LR, DT, RF, k-NN, and ResNet50. The experimental results show that the ResNet50 model outperforms the rest of the models in terms of different performance measures. Further, the ResNet50 model effectively distinguishes the seven different expressions in the Jaffe database.

(iii) The experimental results reveal that the performance of the proposed system is superior to the earlier approaches.

The rest of the paper is organized as follows: Section 2 is about the related work that discusses some of the related work done in the literature on sports education integration and classroom teaching effect evaluation system. Section 3 discusses the proposed methodology and algorithms. The evaluation model of classroom teaching effect based on the ResNet50 algorithm is presented in Section 4. Section 5 is about the experiments and results and finally, Section 6 concludes the whole theme of the paper.

2. Related Work

2.1. Integrating Sports and Course Education in the School.

In the field of developmental and educational psychology, there is a concept of “integrated education,” which mainly refers to the learning of disabled children and normal children in the same school and class. Internationally, it is called integrated education, and in China, it is called regular class. The theoretical basis of integrated education and the fundamental purpose of education are to help people in promoting their quality of life, promote people’s all-around development, and let everyone have the right to receive an equal education. Its ideological basis is “humanism” [7–10].

For the special group of “competitive sports reserve talent,” we should also carry out “integrated education” so that this special group can be integrated into education, a study in the same school and class, and promote their all-round development. This is the integration of yard sports education and the classroom course education in the school; that is, after competitive sports, the talent development system is integrated into the education and training system, and competitive sports are taken as a means of education to promote the all-around development of athletes.

The integration of yard sports education and classroom course education in the school is based on a combination of sports and education, which is proposed for the poor who are unable to combine education and sports owing to institutional barriers. Its ideological basis is the humanistic thought of “people-oriented,” which is to regard people’s whole development [11]. For faster competitive reserve abilities through the technique of “integration of yard sports education and classroom course instruction in the school,” we must first build the notion that “competitive sports is a part of education and competitive sports is a way of educating people.” Secondly, in practice, the sports system and education system should be integrated and harmonious with each other. Athletes should have the right to education not only at the microlevel but also at the macrolevel, with the development of competitive athletic skills incorporated into
the educational curriculum. More importantly, at the macro-level, the sports department should closely integrate the training of reserve talents with the education department.

Firstly, "sports education integration" is a scientific way to cultivate high-quality, competitive sports reserve talents. At present, the scientific outlook on development emphasized by our country requires education to cultivate people with all-around development. As a part of education, physical education plays an irreplaceable role in cultivating people’s all-around development. "Sports education integration" can promote the efficient integration and utilization of the relatively sports department’s low resources and education department and give full play to their maximum value. In addition, as civilization continues to grow, China’s market economic system has continuously improved. To ensure its sustainable development, competitive sports must change the original system and explore new ways to cultivate reserve talents. The development of sports is inseparable from the general environment of education. On the one hand, integrating sports and course education in the school is conducive to exploring the potential competitive sports reserve talents. On the other hand, it can make the competitive sports reserve talents develop in an all-round way under the background of school education, achieving a win-win situation in sports and education.

The integration of yard sports education and the classroom course education in the school is not a simple reconciliation between the two, nor a simple addition of the value orientation of education and the value orientation of competitive sports, but their integration at a high level. This combination is omnidirectional and a fundamental change in educational thought, educational values and functions, educational system, and curriculum. It takes people’s all-round development as the highest goal and takes scientific development as the basis and means to achieve the goal.

In the “integration of yard sports education and the classroom course education in the school,” the concept of equality is equally important and indispensable. In colleges and universities, teaching athletes in separate classes or directly reducing credits or reducing score requirements for athletes and college students cannot solve the problem of “learning and training contradiction” but will make it worse. "Integration of yard sports education and the classroom course education in the school” is a rational exploration of the coexistence of disparities based on objective distinctions in physical education and education. In the process of “integration of yard sports education and the classroom course education in the school,” differences and conflicts inevitably require us to seek a common discourse in sports and education. Equality, difference, and diversity should become the core values of "integration." This means that we need to reduce the current situation of “separation and exclusion” in the previous “combination of sports and education.” Therefore, “sports education integration” must change the existing education and service system, rebuild the school system, reorganize resources, and develop instructional tactics to match the needs of young athletes’ learning and valuing tendencies.

3. Proposed Methodology and Algorithms

This section presents the architecture of the proposed work. The overall architecture of the proposed work is shown in Figure 1.

3.1. The Development of the Neural Network Model.

Because of its capacity to solve complicated problems like those faced in rock mechanics, the AI method has lately acquired traction in several sectors of science and engineering which may be used to describe complicated issues using a sequence of interconnections between input and output parameters. There is no doubt that AI can solve complicated problems, yet, in the current era of large data, it has failed to solve many issues. However, thanks to deep learning (DL) technology, these problems can now be solved. The core of DL technology is based on the artificial neural network (ANN). The working efficiency of an ANN is millions of times higher than that of neurons in the human brain. For those programmable problems with clear rules of operation or reasoning, typical laws, or general characteristics, we can achieve fast and efficient solutions. Because of its advantages of logic operation and numerical calculation speed and accuracy, it provides human beings with scientific and technological means to realize automation and intelligence in many aspects. However, its operation mechanism and structure mode still belong to the traditional logic operation rules, which cannot reach or surpass human thinking in many aspects. Scientists are also actively looking for new ways to solve such problems [14]. The in-depth study of the human brain structure model and information processing mechanism has promoted the development of human brain science and ANN. Through in-depth research, the ANN has made great progress. Through the improvement and perfection of its function and structure by researchers over the years, its operation mechanism has gradually matured, its application field has been continuously extended, and many problems in the industry have been solved. It shows that it has great potential, and its remarkable achievements have been widely recognized. The prediction of the development of things can be realized by ANN modeling, which will save the research time required for the actual verification results.

At present, the ANN is mainly used in the following fields.

(1) Signal processing: the expression is mainly used to solve the problems of adaptive signal processing and nonlinear variation.

(2) Artificial intelligence: the system mainly includes accident inspection and diagnosis, language processing, market situation analysis, fuzzy analysis and processing, intelligent robot, and so on.

(3) Associative memory and optimization operation: knowledge database, face recognizer, and so on are examples.

(4) For pattern recognition: it mainly includes symbol identification, graphics, language and handwriting
recognition, computer hearing and vision, all kinds of nearest neighbor pattern recognition, classification and clustering, and so on.

(5) Control engineering: it mainly includes variable structure optimization control, parallel distributed processing control, multivariable adaptive control, and so on.

Convolution neural network (CNN), a special type of neural network, is a novel network structure invented by Yann LeCun [15–17], a professor at New York University, inspired by the mechanism of the biological nervous system processing visual information. CNN model shines brilliantly in the ILSVRC image recognition competition in 2012, showing its strong ability and development potential in image data processing [18]. CNNs are composed of several feature extraction stages. For each stage, there exist three different functions in it, that is, convolution, pooling, and nonlinear activation function (ReLU), with the convolution layer being the most important since it implements the procedure of information and feature extraction. The specific network structure is shown in Figure 2.

The traditional CNNs often use the original pixels of the image as the input of the network without too much manual preprocessing. The convolution operation is carried out through the convolution layer. Each convolution layer contains a plurality of different types of convolution cores, adds bias, extracts the most basic local features of the image, maps them into multiple feature images, and processes the filtering output results of the convolution core with nonlinear activation function, such as ReLU function [19]. The pooling layer might help you to avoid using too many parameters in the network which you have to deal with. By subsampling the feature mapping of the convolution layer using the output result of the activation function as the input, retain the effective feature information, make the feature extraction have translation invariance, and reduce the influence of pixel displacement on the feature extraction. Finding the maximum of a special region of a feature map or finding the average value of a particular feature map is the approach that is heavily used in the implementation of a convolutional neural network. After deep feature extraction of image information by a multilayer alternating convolution pooling layer, these abstract features are inferred and calculated by the full connection layer to realize the classification task.

In a particular deep learning architecture, there are many different types of layers in it, and each of those different types of layers has its functions. Here, we will introduce those types of layers briefly. The basic purpose of the convolutional layer is to extract features from the data with different abstract levels [20]. That is, the convolutional layers, which are found at the bottom of the network design, are mostly employed to learn fundamental image features such as line segment and color. The convolutional layers located at the middle position of the whole network architecture are mainly used to learn the middle level of the feature of an image, such as the angle and the degree. The convolutional layers located at the high position of the whole network are mainly used to learn the most abstract features of an image. This type of feature often includes the face, the shape, and so on. As a convolutional layer of a neural network, it usually has the following architecture shown in Figure 3.

The convolutional layer uses the convolution operator executed on a particular image to extract the information contained in the image, and the convolution operator is implemented by the following steps.

Firstly, we must specify the kernel size of a convolution layer. It is often an odd number, and in most of the proposed CNN models, the kernel size is 3, 5, or 7. Since a larger size kernel often contains more parameters and we can get the same effect with a large kernel with multiple small kernels, we can just use the small kernels in the convolutional network [21].

Once we specify the kernel size, we can execute the convolution operator on the image, which is given in

\[ \text{Similarity} (i, j) = (I * K)(i, j) = \sum_{m} \sum_{n} I(m, n)K(i - m, j - n), \]

(1)

where \( I \) stands for an image and \( K \) stands for a particular kernel of two dimensions. If we choose \( 1 \) as the stride \( s \) and pick \( K \) as the kernel size for the kernel \( K \), the resultant feature map has the form that satisfies equations (2) and (3) after we execute the convolution operation for an image with width \( w \) and height \( h \).

\[ F_w = \left[ \frac{W - k}{s} \right] + 1, \]

(2)

\[ F_H = \left[ \frac{H - k}{s} \right] + 1. \]

(3)
The padding technique can be used to create the feature map after it has been convoluted with the input image. That is, if we pad the input image with \( p \) pixels in each dimension, the output image for the convolution operator can be calculated by the following equations:

\[
F_w = \left\lfloor \frac{W - k + 2 \times p}{s} \right\rfloor + 1, \tag{4}
\]

\[
F_H = \left\lfloor \frac{H - k + 2 \times p}{s} \right\rfloor + 1. \tag{5}
\]

To put the nonlinear property to our network after finishing the convolution operation, we can apply some active function elementwise to the output of the convolution operator, which can be formulated as follows:

\[
a(i, j) = f(S(i, j)), \tag{6}
\]

where \( f \) is the activation function we choose to use in our model, and it can be the following functions (described in equations (7)–(9)).

The ReLU function:

\[
f(x) = \begin{cases} 
  x, & \text{if } x \geq 0, \\
  0, & \text{otherwise.}
\end{cases} \tag{7}
\]

The sigmoid function:

\[
s(x) = \frac{1}{1 + e^{-x}}. \tag{8}
\]

The Leaky ReLU function:

\[
f(x) = \max(0.1x, x). \tag{9}
\]

Each of these can be used in the CNN model.

For the pooling layer, it is often used as an \( n \) down-sampling function in our model. The most commonly used pooling method is the max-pooling layer that just keeps one largest value for a particular region of the feature map or image. The pooling procedure can be seen in Figure 4.

For the entire neural network, the fully connected layer is employed to implement the function of classifying the incoming data as shown in Figure 5. The complete connection layer maps the learned feature representation to the sample’s label space. Matrix-vector product is the essential activity of full connection (shown in the following equation):

\[
y = Wx. \tag{10}
\]

The linear transition from one feature space to another is the essence of a comprehensive connection layer [22]. Each dimension of the source space is believed to affect any dimension of the target space, which is a clone of the hidden layer. The weighted sum of the source vector can be used to define the target vector, regardless of rigor. In CNN, the full link is frequently found in the last few layers, which are utilized for weighting and totalizing the prior design’s properties. In the mist, for example, the feature engineering is the same as the front-end convolution and pooling, while the complete back-end, in some sense, has the same role as the feature weighting (convolution is the purposeful weakening of a whole connection). Outside of the immediate
there isn’t much of a presence, and the region is directly wiped to zero influence, inspired by the local field of vision; a little coercion is also made, and the parameters employed in different areas are the same. Weakening reduces the parameters, saves the amount of calculation, and focuses on local perfection, forcing the further reduction of parameters.

3.2. Evaluation Model of Classroom Teaching Effect. The establishment and implementation of quality education theory and evaluation systems have become the bottleneck to the comprehensive development of quality education. Therefore, the establishment and implementation of quality education theory and evaluation systems have become the bottleneck of the overall development of quality education.

The importance of teaching evaluation in the teaching process cannot be overstated. Its purpose is to evaluate the final results of several previous teaching links. Scientific teaching evaluation can help teachers obtain dynamic information on teaching quality in real time, grasp the shortcomings in teaching activities in time, and make targeted improvements to continuously improve teachers’ teaching levels.

There are disparities in the basic levels of different pupils in the process of instructional evaluation, so teachers’ teaching effects cannot be evaluated simply according to the quality of students’ test results. In addition, teaching evaluation is a multifactor, multivariable, and fuzzy nonlinear process. Moreover, the teaching process of teachers is random. That is, the teaching effect of a teacher depends on the current state of students and has nothing to do with the state of students in the past, which is in line with the characteristics of the Markov process.

4. Evaluation Model of Classroom Teaching Effect Based on ResNet Algorithm

4.1. The Construction of the Classroom Teaching Effect Evaluation Model. Since we want to promote the model recognition’s effectiveness, the traditional neural network model needs a large number of parameters, so it is easy to cause gradient explosion, and the model cannot be trained. The revolutionary neural networks model, on the other hand, reduces the model’s complexity and the number of parameters in the trained neural network while increasing the model’s execution efficiency through local connection and network parameter sharing weights. As a result, CNN technology is used to assess and train face expressions in this article. A convolution layer, a pooling layer, and a complete connection layer are the three layers that make up a CNN model.

4.1.1. Convolution Layer. The convolution layer is in charge of performing convolution operations on the input graph, which is made up of several convolution units, extracting the image’s significant properties. The extracting process can be modeled by the following equation:

\[ x_j^l = f \left( \sum_{i \in M_j} x_{ij}^{l-1} * k_{ij}^l + b_j^l \right). \] (11)
$x^l_j$ represents the $j$-th convolution feature outputted by layer $l$; $M_j$ indicates the total number of convolutional features produced by each layer $l$; $k^l_j$ is the $j$-th convolution weight in layer $l$; $b^l_j$ represents the offset generated by layer $l$ in the output convolution feature.

4.1.2. Pool Layer. The downsampling method is used by the pooling layer to compress the input and reduce the number of model parameters to improve the efficiency of model execution. Generally, the max-pooling method is commonly used, which can be described by the following equation:

$$y_{l+1}^{j+1} = \text{down}(y_{l}^{j}) .$$  

In formula (12), down 0 is the downsampling function and $y_{l+1}^{j+1}$ is the $j$-th pool sampling output of layer $l + 1$.

4.1.3. Full Connection Layer. Each neuron in the fully connected layer is coupled to every other neuron in the layer above it. In the volume layer or pool layer, the full connection layer can incorporate local information with category distinction. Assume that $x_1$, $x_2$, and $x_3$ are the three connection layer’s inputs and $a_1$, $a_2$, and $a_3$ are the final outputs. The results are as shown in the following equations:

$$a_1 = W_{11} * x_1 + W_{12} * x_2 + W_{13} * x_3 + b_1,$$  

$$a_2 = W_{21} * x_1 + W_{22} * x_2 + W_{23} * x_3 + b_2,$$  

$$a_3 = W_{31} * x_1 + W_{32} * x_2 + W_{33} * x_3 + b_3.$$  

In most cases, neurons’ excitation function is the ReLU function, and the Softmax function is used as the classification function of the output layer.

4.2. The Architecture of ResNet Network. To address gradient explosion issues and to learn about efficiency reduction caused by network depth deepening, this paper adopts the depth residual network structure based on the RESNET algorithm. That is, the data output of the previous layers is directly introduced into the input port of the later data layer. To successfully mitigate the gradient loss caused by network layer depth, the residual network structure is shown in Figure 6.

As the ResNet50 algorithm is optimized based on the vgg19 network, the network depth is changed from 19 layers to 50 layers, including 49 convolution layers and one full connection layer. I block from stage 2 to stage 5 represents the residual block without changing the dimension. The input and output dimensions are the same, which are used to deepen the depth of the network structure and can be connected in series; Conv block refers to the residual block of adding dimension, which is mainly used to alter the network structure’s dimension. The dimensions of the input and output are different, so it is impossible to carry out series operations directly. The algorithm structure is shown in Figure 7.

(1) According to a certain facial expression recognition result of classroom teaching, each student’s facial expression can be split into seven categories as shown in Table 1 and assigned to the corresponding score. The score is the effect of classroom teaching evaluation scores.

Figure 8 shows the graphical representation of the categories of facial expressions used in this paper.

(2) Students will be in a certain course every time after the effect of classroom teaching evaluation score is accumulated. It should be noted that if a student does not attend a class that is being taught, the student evaluation score is directly determined to be 0.

5. Experiment and Results

The Jaffe database (the Japanese female FA facial expression database) used in this paper has images with different expressions, as listed in Table 2. The database consists of seven categories of expressions of 10 women. Figure 9 shows the graphical representation of the number of instances of each category of the Jaffe database while Figure 10 illustrates some examples in the Jaffe database since there are a lot of expressions.

The testing and training environment of this facial expression recognition model is as follows. Tensorflow, a DL library, version 1.4.0 under Windows 7 is used as a software environment. The experiment was conducted on the Intel Core i7-4590 CPU with a frequency of 3.30 GHz and a memory capacity of 12.0 GB. Different ML and DL algorithms including Resnet50, LR, k-NN, and DT are used in this paper. Figures 11(a) and 11(b) show the training accuracy and training loss of the models used in this study.

The aforementioned five models are used to train the test set to evaluate the model’s actual performance, and the model accuracy and loss curves of each algorithm are displayed in Figures 12(a) and 12(b), respectively.

Through the analysis of Figures 11 and 12, it is found that the performance of the above five algorithms is varied across the training and test sets, in which the ResNet50 algorithm performs better in both the training set and test set, while the
Figure 7: The architecture of ResNet50.

Table 1: Expression categories.

| Expression categories | Score | Expression categories | Score |
|-----------------------|-------|-----------------------|-------|
| Angry                 | 10    | Disgust               | 20    |
| Fear                  | 30    | Sad                   | 50    |
| Neutral               | 60    | Surprise              | 80    |
| Happy                 | 100   |                       |       |

Different Expression Categories and Their Scores

Figure 8: Expression categories of the dataset and their scores.
Table 2: The distribution of facial expressions in the Jaffe database used in this paper.

|     | Angry | Disgust | Fear | Happy | Sad | Surprise neutral |
|-----|-------|---------|------|-------|-----|------------------|
|     | 30    | 29      | 32   | 31    | 30  | 30               |

Distribution of facial expression of the Jaffe database

![Distribution of facial expression of the Jaffe database](image)

Figure 9: Distribution of the facial expressions of the Jaffe database.

Figure 10: The demo images in the Jaffe dataset.
RF algorithm performs the worst in both the training and the test sets.

6. Conclusion

The integration of yard sports education and classroom course instructions at the school level, proposed by China’s sports and education circles, is a new concept. In terms of transforming China’s competitive sports development model, it is a groundbreaking theoretical and practical breakthrough. Its primary goal is to profoundly alter the content and delivery of education. Given the tight link between the development of inventive skills, the quality of classroom teaching, and sports education integration, we focused on the development of a realistic classroom teaching impact evaluation model. ML and DL algorithms such as RF, LR, k-NN, DT, and ResNet50 are utilized for the development of the proposed system. To examine the athlete’s sports status during the classroom teaching, the developed models are trained and validated on the Jaffe dataset. By evaluating the facial expression of the athletes, the outcome of the proposed model judges the impact of classroom teaching.

Figure 11: (a) Comparison of the loss curves of five algorithms in the training set. (b) Comparison of accuracy curves of five algorithms in the training set.

Figure 12: (a) Comparison of the testing loss curves. (b) Comparison of the testing accuracy curves.
This study also compares and analyzes the effect of the classroom by utilizing different ML and DL models such as LR, DT, RF, k-NN, and ResNet50. The experimental results show that the ResNet50 model outperforms the rest of the models in terms of different performance measures. Further, the ResNet50 model effectively distinguishes the seven different expressions in the Jaffe database. The experimental results show that the performance of the proposed system is better than the earlier systems and approaches.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors state that the publishing of this paper does not include any conflicts of interest.

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