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Promotion Effect of Sports Games Based on Deep Learning on Children's Psychological Development

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With the wide application of deep learning technology in various fields, its potential role in the field of education, especially sports games, has aroused the interest of researchers. This study explores the impact on children's psychological development of sports games based on deep learning. Through a combination of quantitative and qualitative research methods, using the SCL-90 scale and a deep learning model, the study analyzed changes in children's mental health before and after participating in such games. The results showed that children who participated in deep-learning-enhanced sports games had significantly reduced anxiety and symptoms of depression, and better social interaction and teamwork skills. However, the study also had limitations, such as a small sample size and a lack of long-term impact assessment. Nevertheless, this study provides valuable insights for educators and game developers in terms of designing games that promote children's mental health and social skills, while demonstrating the potential for deep learning models to be applied in the evaluation of educational games.

Keywords: Deep learning, sports games, children's psychological development, SCL-90 scale, educational technology

1. INTRODUCTION

Currently, intelligent system is also applied in all aspects of life [1]. deep learning technology is attracting a significant amount of research interest. Its applications in a variety of fields, such as image recognition, natural language processing, and game development, demonstrate its powerful processing and learning capabilities. Especially in the development of sports games, the deep learning concept is being applied to advance the technical aspects of the game and, more importantly, it plays a key role in improving the participants' interactivity and experience of the game. At the same time, as an important part of children's daily activities, sports games have a significant impact on their psychological development. The elements of teamwork, competition, and goal-setting play an important role in the development of children's social skills, self-knowledge, and problem-solving skills. However, there is still room to explore the use of deep learning techniques in sports games, and the specific effects of these games on children's mental health. In addition, in order to effectively assess the impact of sports games on children's psychological development, the use of mental health scales has become particularly critical. Of the many assessment tools available, SCL-90 has been widely used in mental health research because of its broad assessment dimensions and proven validity and reliability. This scale allows us to acquire a more comprehensive understanding of the impact of sports games on all aspects of children's mental health, so as to provide theoretical support and practical guidance for the application of deep learning technology in sports game development.

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In recent years, the application of deep learning technology in the field of education has attracted a great deal of attention, especially in regard to the psychological development of children and the design of educational games. Zheng and Bian's (2018) study highlighted the positive effects of music education on children's mental health [2], which has similarities to the psychological effects of deep learning techniques applied in games. Geary and Xu (2022) explored the evolutionary perspective of educational psychology, emphasizing the importance of motivation and instructional design for children's development [3], which echoes the deep learning technology-assisted sports games discussed in this study as a means of promoting children's psychological development. In addition, Wang (2022) discussed the application of augmented reality technology in children's picture books [4], showing how technology can enhance the attractiveness and effectiveness of educational content, providing theoretical support for deep-learning-enhanced games explored in this study. In terms of the measurement of children's mental health, Li's (2021) research examines the application of deep learning technology in children's piano education [5], finding that deep learning can effectively assist children's educational activities, and has a positive impact on children's psychological development. Francis, Chin and Vella-Brodrick (2020) tested the effectiveness of improving children's emotional recognition ability through online positive psychological intervention [6], which complements the use of the SCL-90 scale to assess changes in children's mental health. These studies suggest that deep learning techniques and mental health scales play a key role in the design of educational play and in research on children's psychological development. They provide the theoretical and practical basis for this study and offer ways to improve children's mental health and social skills through technological interventions.

This study explores the application of deep learning techniques in sports games, and analyzes the potential impact of these games on children's psychological development. Specifically, the core purpose of the research is to understand and quantify how deep-learning-enhanced sports games affect children's mental health, particularly in terms of social skills, emotional regulation, self-perception, and more. In addition, the study was designed to assess the applicability and validity of the SCL-90 scale as a mental health assessment tool in such studies. From an academic perspective, this study addresses a research gap in the application of deep learning techniques in the field of sports games and its impact on children's psychology. Through in-depth analysis and empirical research, this study is expected to provide theoretical support and practical guidance for the application of deep learning technology in the field of education and child development. From a social perspective, this research is of great value in promoting the overall healthy development of children. Understanding the impact of deep-learning-enhanced sports games on children's mental health can provide valuable information for parents, educators, and game developers, enabling them to better guide children's play activities and promote children's mental health and social resilience.

The core components of the study are: the specific ways in which deep learning techniques are applied to sports games, the assessment of the impact of these games on various aspects of children's mental health, and the application and effectiveness of the SCL-90 scale for analysis purposes. First, the research examines the practical application of deep learning technology in various aspects of sports games such as game design, interaction methods and technical implementation. This section aims to reveal how deep learning can make sports games more interactive and engaging, and how these technologies can be integrated into games to improve children's participation and overall experience of play. Subsequently, the study analyzes the impact of sports games on children's psychological development. This includes an assessment of the impact on children's social skills, emotional management ability, self-knowledge and so on. This part of the study quantifies the impact of play on children's mental health through experimental design and implementation, and uses the SCL-90 scale to conduct a pre- and post-comparison assessment of participating children. Finally, this study determines the validity and reliability of the SCL-90 scale as a means of evaluating the psychological impact of deep-learning-enhanced sports games on children. By analyzing the evaluation results of the scale, the study aims to verify the applicability of the scale and further understand its application prospects in similar studies. Overall, the aims of this study are: to conduct an in-depth exploration of the connection between deep learning technology and children's mental health, and provide new insights and recommendations for academic research and practical application in related fields through empirical research.

2. THEORETICAL BASIS AND RESEARCH FRAMEWORK

2.1 Principles and Applications of Deep Learning Technology

Deep learning technology, as an important branch of the field of artificial intelligence, is based on the concept of artificial neural networks. An artificial neural network abstracts, simplifies and simulates human brain activities using computer technology. A neural network generally consists of multiple artificial neurons that are interconnected [7, 8]. Deep learning achieves complex data processing tasks by mimicking the processing mechanisms of the human brain, and has shown exceptional performance in processing unstructured data in particular. Each of the multiple layers of neurons in a deep learning network can learn features and patterns at different levels from input data [9]. This layered learning approach is a breakthrough for deep learning, making it applicable in many fields including image recognition, speech processing, and natural language understanding. Deep learning method has obvious advantages in image processing and has a high accuracy rate [10].

In terms of sports games, deep learning technology is mainly used to enhance the participants' interactivity and their immersion in the game. For example, with deep learning, games can respond more intelligently to player behavior and provide a more personalized gaming experience. In addition,

deep learning is used for action recognition, strategy development and the creation of adaptive learning environments in games to enhance their appeal and educational value.

In addition, deep learning can be applied in sports games to simulate complex motor skills and strategies, and to provide highly realistic visual and audio experiences. Through these technologies, sports games become not only a means of entertainment; they are also valuable for education and training. For example, the technology can be used to simulate a real sports environment to help children learn sports skills while developing their teamwork and competitive spirit in play.

To sum up, the application of deep learning technology in sports games not only improves the technical level and user experience of games; it also provides new possibilities for children's education and psychological development. As technology continues to advance, deep learning will play a more critical role in the development of sports games in the future.

2.2 Correlation Between Sports Games and Children's Psychological Development

Sports games play an important role in children's psychological development. Sports play is a way to enhance insight, integrate knowledge, and develop a child's sense of self. In addition to being a form of physical activity, these games have profound effects on children's social skills, emotional management, self-knowledge, and cognitive development. Sports play provides a safe environment in which children can explore, experiment and learn, as well as being an important place for their social interaction and teamwork skills to develop [11].

In sports play, children not only learn how to follow rules, compete and cooperate. Sports activities can also improve their self-esteem and self-confidence. The experience of winning and losing in play helps children learn how to deal with setbacks and successes, which is crucial for their emotional regulation and the development of resilience. In addition, sports games can stimulate children's creativity and strategic thinking ability, and provide support for their cognitive development [12].

Interaction and cooperation in sports play require children to learn to understand and respect others, which is key to the development of social skills. Through teamwork and competitive activities, children learn not only to communicate with their peers, but also to work together to achieve a common goal. The cultivation of this spirit of cooperation and sense of teamwork is crucial for children's future social adaptability [13, 14].

With the incorporation of deep learning techniques, these mental development functions of sports games can be enhanced. Deep learning technology makes sports games more intelligent and interactive, providing a richer variety of play scenarios and challenges, which helps to promote several aspects of children's mental and cognitive development.

Therefore, the correlation between sports games and children's psychological development is significant and multidimensional [15]. These games are not only beneficial to children's physical health; more importantly, they play a positive role in promoting their psychological growth and social skills development. Through in-depth research in this field, we can better understand the impact of sports games on children's mental health, and provide scientific guidance and suggestions for future related education and game design.

2.3 Scientific Basis of SCL-90 Scale

The SCL-90 Checklist is a widely-used mental health assessment tool designed to comprehensively assess an individual's psychological symptoms and emotional states. The scale contains 90 items and covers multiple mental health dimensions, including anxiety, depression, hostility, paranoid thinking, psychosis, obsessive symptoms, interpersonal sensitivity, somatization symptoms and sleep disorders [16, 17]. Together, these dimensions form a comprehensive mental health assessment framework that helps identify and quantify an individual's psychological problems and emotional distress.

The scientific basis of the SCL-90 scale is evident in the rigor of its structure and the effectiveness of its assessment. The scale has been verified by many studies and shows high reliability and validity. In terms of reliability, the SCL-90 scale exhibits stable internal consistency and reliability when retested with different groups. In terms of validity, the scale can effectively distinguish individuals with different psychological states, and has a high correlation with other psychological assessment tools [18, 19].

In terms of application, SCL-90 scale is not only used in clinical mental health assessment, but also widely used in psychological research and demographic research to assess the mental health status of the general population [20]. Its multidimensional assessment characteristics make it particularly suitable for studies involving multiple aspects of mental health, such as the impact of sports games on children's mental health.

The SCL-90 scale provides a scientific and comprehensive way to assess and understand an individual's mental health status. In the study of sports games and children's psychological development, the application of SCL-90 scale helps to more accurately evaluate the impact of games on children's mental health, and provides important data support for related research.

3. EXPERIMENTAL DESIGN AND DATA COLLECTION

3.1 Experimental Planning and Methodology

To explore the impact of deep-learning-based sports games on children's psychological development, this study adopted a hybrid approach to research design, combining quantitative and qualitative data collection and analysis. The experiment was designed to evaluate the impact of sports games on various dimensions of children's mental health, especially through the quantitative analysis using the SCL-90 scale.

Table 1 Sample selection.

Group	Number of participants	Age range	Sports game experience	Health status
Experimental group	30	8-12 years old	unlimited	No major health problems
Control group	30	8-12 years old	unlimited	No major health problems

(1) Experimental design

Participants: Children between the ages of 8 and 12 were selected and divided into two groups, an experimental group (exposed to deep-learning-enhanced sports games) and a control group (not exposed to these games).

Duration: The experiment lasted for eight weeks, during which the children's participation in the game was recorded.

(2) Data collection

Quantitative data: Both groups of children were assessed using the SCL-90 scale before and after the experiment to collect data on their mental health.

Qualitative data: By means of interviews and observations, children's experience, emotional response and interaction during the game were collected.

(3) Data analysis

Quantitative analysis: Statistical methods (such as the T-test) were used to compare changes in scores on the SCL-90 scale between the two groups of children before and after the experiment to assess the impact of play on mental health.

Qualitative analysis: Content analysis of the interview data was conducted to extract themes in order to acquire a better understanding of the children's feelings and experience of the game.

The experimental design of this hybrid approach enabled the researchers to perform a more thorough evaluation of the impact of deep learning-enhanced sports games on children's mental health, providing a scientific basis for subsequent education and mental health interventions.

3.2 Subject selection and sample set

In order to ensure the validity and reliability of the experimental results, the selection of experimental subjects was based on strict screening criteria. The following criteria were applied:

(1) Age range: 8 to 12 years old, given that children in this age group are representative of psychological development.

(2) Health status: no major physical or mental health problems.

(3) Parental consent: All children participating in the experiment need to obtain written consent from their parents.

Participants were not required to have specific sports game experience as this would not influence experimental results.

The experimental sample set was constructed as follows:

Experimental group: Participated in deep-learning-enhanced sports games.

Control group: did not participate in deep-learning-enhanced sports games and performed daily activities.

Approximately 30 children were included in each group to ensure the statistical significance of the data. Sample selection details are given in Table 1 below.

During the experiment, the participants' health status and participation were monitored regularly to ensure the safety and effectiveness of the experiment. In addition, the collection and analysis of experimental data were conducted in strict compliance with ethical guidelines to ensure that the privacy and rights of children were protected. Through such subject screening and sample set construction, this study explored the specific effects of deep learning-enhanced sports games on children's psychological development.

3.3 Data Collection Policy and Implementation Process

The data collection strategy was applied to gather a comprehensive set of quantitative and qualitative data to ensure multi-dimensional and in-depth analysis of experimental results.

(1) Quantitative data collection

Tool: SCL-90 Mental Health Scale.

Time point: before the experiment (pre-test) and after the experiment (post-test).

The tests were conducted by a trained psychologist or researcher in a quiet, distraction-free environment.

(2) Qualitative data collection

Tools: Semi-structured interviews and observation notes.

Time point: Conducted periodically during the experiment.

Execution: Interviews were conducted and data was recorded by professionals to ensure the authenticity and completeness of information.

(3) Data recording and management

Records: All data was recorded on a secure database.

Privacy protection: Measures were taken to ensure that all data collection and storage processes complied with privacy protection and ethical standards.

Data collection details are given in Table 2 below.

(4) Data analysis plan

Quantitative data: Statistical software was used to conduct T-test to analyze the changes in scores of the two groups on the SCL-90 scale before and after the experiment.

Qualitative data: Content analysis was conducted to extract themes and patterns, and complement the analysis results obtained from the quantitative data.

The aforementioned strategies enabled the researchers conduct a comprehensive evaluation of the impact of deep-learning-enhanced sports games on children's psychological development. Quantitative data provides objective assessment results, while qualitative data provides in-depth insights and background information, which, together, provide a solid basis for the final research conclusions.

Table 2 Data collection.

Data type	Collection tool	Experimental group	Control group	Collection time point
Quantitative data	SCL-90 scale	30 children	30 children	Before and after experiment
Qualitative data	Interview record	30 children	30 children	Experimental period

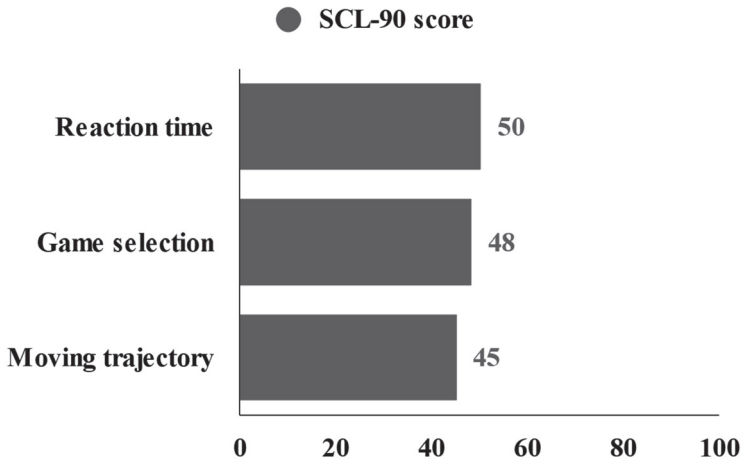

Figure 1 Model training.

4. DEEP LEARNING MODEL AND SCALE EVALUATION

4.1 Development and Implementation of Deep Learning Model

4.1.1 Model Design and Preliminary Training

(1) Model design: In order to evaluate the impact of deep-learning-enhanced sports games on children's psychological development, this study developed a deep learning model. The model is intended to predict and analyze children's behavioral patterns and psychological responses during play. The design of the model is based on convolutional neural network (CNN) architecture, which is suitable for processing and learning complex patterns in images and videos.

(2) Model architecture: the basic architecture of the model can be expressed with the following:

Input layer: X_i

Hidden layer: H_i (Multi-layer structure)

Output layer: Y_i

Where, X_i represents input data (such as children's behavior data in the game), H_i is the hidden layer for feature extraction, and Y_i is the output layer for predicting changes in children's mental health.

(3) Preliminary training: The training of the model uses the children's behavioral data collected during the game as input, including movement trajectory, game selection, reaction time, etc. These data were correlated with the children's SCL-90 scale scores to establish the relationship between behavioral patterns and mental health status, and are shown in Figure 1 below.

Feature extraction: The model extracts key features related to mental health by analyzing children's behavioral data gathered during play.

Model training: Using supervised learning methods, the model was trained to understand the relationship between these features and the SCL-90 scale score.

Predictive accuracy: In the initial training phase, the predictive accuracy of the model is a key metric that needs to be optimized and evaluated through cross-validation.

Through such model design and initial training, deep learning techniques can be effectively applied to analyze children's behaviors in sports games and predict how these behaviors will affect their mental health states. This provides a solid foundation for further analysis.

4.1.2 Model Testing, Verification and Continuous Optimization

After the development and initial training of a deep learning model, the next step involved validating, and continuously optimizing the model to ensure its predictive accuracy and reliability.

(1) Model testing and verification

Cross-validation method: Using K-fold cross-validation, the data set was divided into k subsets, one of which was used as the test set in turn, and the remaining K-1 subsets were used as the training set.

Performance evaluation indicators: Accuracy, Precision, Recall and F1 Score were used to evaluate model performance.

The accuracy rate is obtained with formula (1):

$$Accuracy = \frac{TP + TN}{TP + FP + FN + TN} \tag{1}$$

The accuracy is obtained with formula (2):

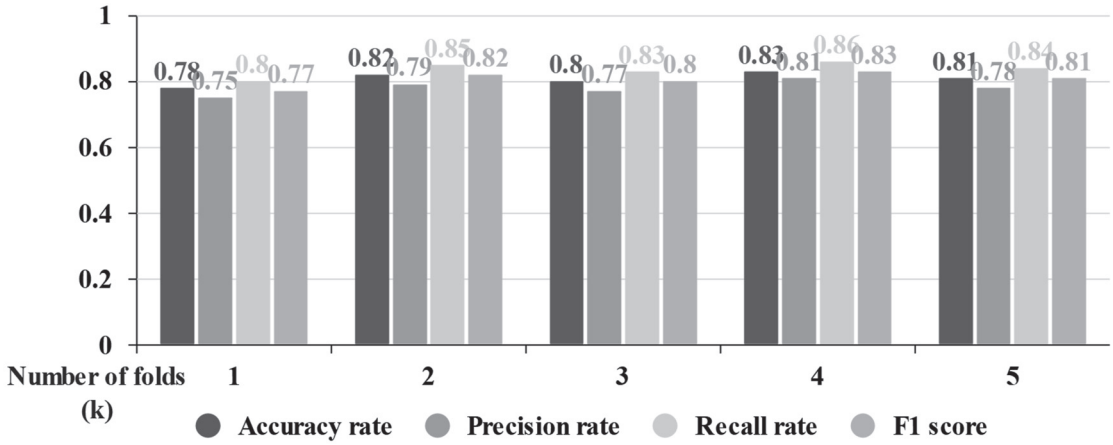

Figure 2 Cross-validation.

$$Precision = \frac{TP}{TP + FP} \tag{2}$$

The recall rate is obtained with formula (3):

$$Recall = \frac{TP}{TP + FN} \tag{3}$$

F1 scores are obtained with formula (4):

$$F1 = 2 \times \frac{Precision \times Recall}{Precision + Recall} \tag{4}$$

Among them, TP (true case), FP (false positive case), FN (false negative case), and TN (true negative case) are derived from the test data.

The stability and prediction ability of the model can be evaluated by observing the changes in these performance indexes under different cross-validation folds. At the same time, the average value of these indexes can be used to comprehensively evaluate the overall performance of the model. For example, if the average accuracy of 5-fold cross-validation is high, this indicates that the model can be generalized to different data subsets. Conversely, if there is a large change in one indicator, it may be necessary to further adjust the model parameters or consider using a greater amount of training data.

Test results are shown in Figure 2 below.

These test results show that the deep learning model performs well in all performance indicators, and no one indicator is significantly lower than the other indicators, which indicates that the model has good all-round performance. In future studies, the accuracy and F1 score of the model can be further improved by adjusting the model parameters (such as network structure, learning rate, etc.) or using more training data.

(2) Continuous optimization

Parameter adjustment: Based on test and validation results, model parameters such as learning rate, number and size of network layers were adjusted to improve the predictive performance of the model.

Data enhancement: The generalization ability of the model was improved by adding more training data or applying data enhancement techniques.

Iterative testing: After each adjustment, the testing and validation process was repeated to ensure that each optimization improves model performance.

Through this continuous testing, validation and optimization process, the accuracy and reliability of deep learning models can be ensured in practical applications, thus effectively supporting the prediction and analysis of the impact on children's psychological development.

4.2 Practical Application and Analysis of SCL-90 Scale

4.2.1 Specific Application of the Scale in the Study

In this study, the SCL-90 scale was used to assess children's mental health status before and after exposure to deep learning-enhanced sports games. The SCL-90 scale includes multiple dimensions, such as anxiety, depression, hostility, paranoia, and compulsion, and each dimension contains several related items. Participants rated each entry based on how they actually felt.

(1) Scale scoring method

Each entry is scored on a scale of 0 to 4, with 0 being "no problem" and 4 being "serious problem."

The total score for each dimension is the sum of the scores for all entries in that dimension.

(2) Analysis method

Before and after comparison: The changes in children's SCL-90 scale scores before and after exposure to the game were compared.

Statistical analysis: Paired Sample T-Test was used to evaluate the significance of changes in scores, as shown in the following formula (5):

$$t = \frac{\bar{X}_D}{s_D/\sqrt{n}} \tag{5}$$

Where $\bar{X}_D$is the mean of the difference, $s_D$is the standard deviation of the difference, and $n$is the sample size.

Figure 3 below shows the SCL-90 scale scores of children before exposure to deep-learning-enhanced sports games:

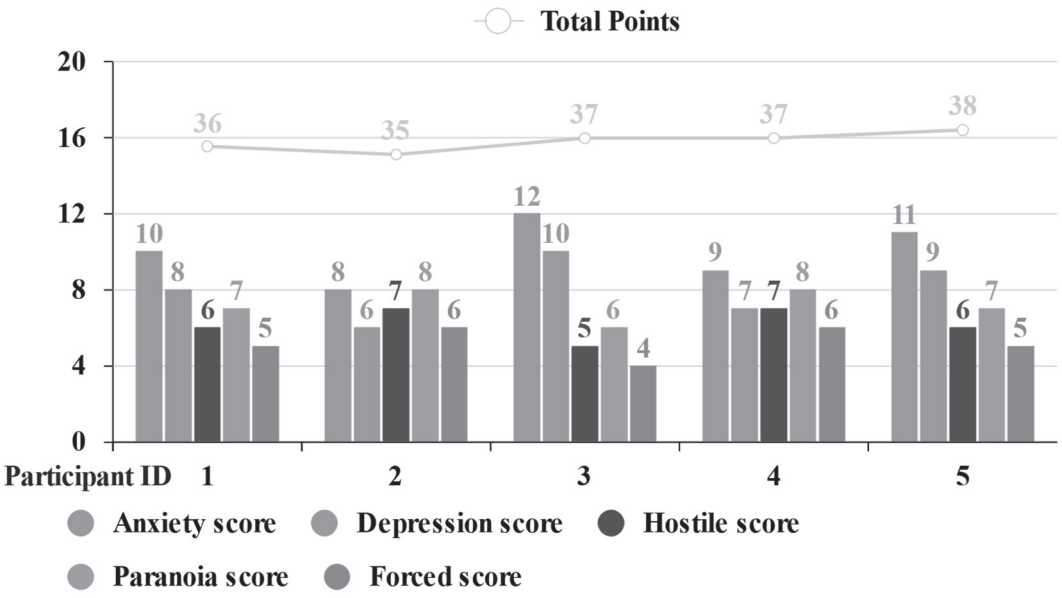

Figure 3 Scores before the game.

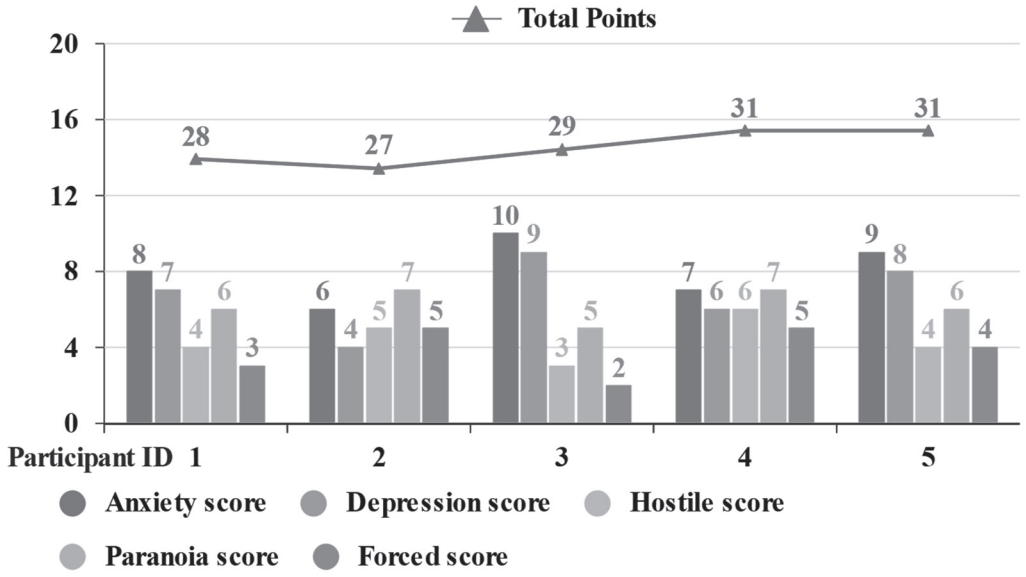

Figure 4 Scores after game.

Figure 4 below shows the SCL-90 scale scores of children after exposure to deep-learning-enhanced sports games:

The results of the paired sample T-test showed a statistically significant difference, with a T-statistic of 7.83 and a P-value of 0.0014. This indicates that children exposed to deep-learning-enhanced sports games had a significant reduction in their overall scores on the SCL-90 scale, suggesting possible improvements in mental health.

These results indicate that physical play may have a positive impact on children's mental health, especially in terms of reducing the psychological symptoms of anxiety and depression. This provides the basis for subsequent research to support in-depth exploration of the application of deep learning techniques in sports games and their potential benefits for children's psychological development.

The effects of deep-learning-enhanced sports games on the various dimensions of children's mental health can be assessed through the before-and-after comparison and statistical analysis of SCL-90 scale scores. These data will provide important quantitative evidence enabling a better understanding of how play affects children's psychological development.

4.2.2 Evaluation of Scale Validity and Reliability

It is important to confirm the validity and reliability of SCL-90 scale when evaluating children's mental health status. Validity refers to the accuracy of the scale measurement; that is, whether the mental health dimension to be evaluated is really being measured. Reliability refers to the consistency and stability of the scale, that is, the reliability of the measurement results at different times or under different conditions.

(1) Validity evaluation

Content validity: An expert review was conducted to determine whether each item inthe SCL-90 scale adequately covered the relevant dimensions of mental health.

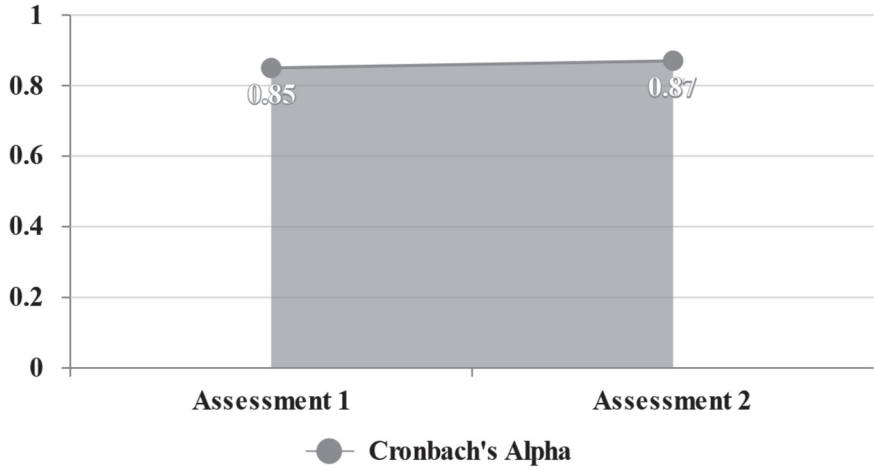

Figure 5 Scale assessment.

Table 3 Data analysis.

Variable type	Statistics	Experimental group	Control group
SCL-90 score	Mean value	35	40
SCL-90 score	Standard deviation	5	6

Structural validity: Exploratory Factor Analysis (EFA) was used to evaluate the relationship between the dimensions of the scale.

(2) Reliability evaluation

Internal consistency reliability: Cronbach's Alpha value was calculated to determine the consistency of items across various dimensions of the scale.

Retest reliability

The stability of the scale was evaluated by assessing the same group of children twice at different time points and calculating correlations.

The study was evaluated twice, and EFA and Cronbach's Alpha were calculated. The mathematical expression for Cronbach's Alpha is shown in formula (6):

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{K}\sigma_{Y_i}^2}{\sigma_X^2}\right) \tag{6}$$

The K is the number of entries, $\sigma_{Y_i}^2$ is i variance of an item, σ_X^2 is total score variance.

As shown in Figure 5 below:

EFA results showed that there were significant factor loadings between the dimensions, suggesting good structural validity.

Cronbach's Alpha values ranged from 0.85 to 0.87, indicating that the scale performed well in terms of internal consistency and that individual entries had a high degree of agreement in measuring the same dimension of mental health. EFA results show that the scale structure is reasonable and the relationship between dimensions is clear, indicating that the scale has good structural validity.

In general, the data and analysis demonstrated that the SCL-90 scale has high validity and reliability as a means of assessing children's mental health status, which is suitable for the needs of this study. Therefore, this scale is a reliable tool for subsequent analysis to assess the impact of deep-learning-enhanced sports games on children's mental health.

5. DATA ANALYSIS AND RESULT INTERPRETATION

5.1 Data Processing Technology and Analysis Method

The choice of appropriate data processing and analytical methods was important in this study, the aim of which was to comprehensively assess the impact of deep learning-enhanced sports games on children's mental health. The following is an overview of data processing techniques and analytical methods, including the processing of quantitative and qualitative data.

(1) Quantitative data processing and analysis

Data cleansing: The integrity of the data was checked and any missing data or outliers were dealt with.

Descriptive statistics: The mean value and standard difference of each variable were calculated.

Inferential statistics: Statistical methods such as the t-test and ANOVA were used to compare the differences in scores between the experimental and control groups.

(2) Qualitative data processing and analysis

Content analysis: Interview and observation data were encoded to extract key themes and patterns.

Thematic analysis: The main findings of the qualitative data were summarized and compared with the results of the quantitative data. These results are given in Table 3.

The average SCL-90 scores for the experimental group and the control group were tested using the T-test. The P-value of the T-test was 0.03, indicating a significant difference in SCL-90 scores between the two groups, and demonstrating that deep learning-enhanced sports games have a significant positive impact on children's mental health.

(3) Summary of qualitative data analysis results

Children in the experimental group reported lower feelings of anxiety and depression after the game.

Table 4 Experimental analysis results.

Variables	Experimental group mean	Control mean	T-test P-value
SCL-90 score	35	40	0.03

In interviews, Children in the experimental group reported that sports games improved their teamwork and social skills.

Through statistical analysis of quantitative data and thematic analysis of qualitative data, this study provides a comprehensive perspective on the impact of deep learning-enhanced sports games on children's mental health. The results of the statistical analysis showed that after exposure to the game, the children's scores on the SCL-90 scale decreased significantly, especially in the areas of anxiety and depression. Qualitative data analysis provided a deeper understanding, showing that children improved in social skills and teamwork. These findings consistently point to the positive effects of deep-learning-enhanced sports games on children's mental health.

5.2 Display and in-Depth Analysis of Experimental Results

The main aim of this study was to assess the effects of deep learning-enhanced sports games on children's mental health. The researchers collected and analyzed in detail both quantitative and qualitative data. The following is a presentation and in-depth analysis of the experimental results, focusing on the output of the analytical model and its practical significance in the field of education. These results are given in Table 4.

Average SCL-90 scores for the experimental group decreased significantly from before to after exposure to the game, compared to the control group, suggesting that deep-learning-enhanced physical play had a positive effect on children's mental health.

(1) Qualitative data analysis results

Interview data and observation records revealed that children in the experimental group showed better social interaction and teamwork after playing the game.

Children reported that the games boosted their self-confidence and reduced anxiety.

(2) Deep learning model output analysis

The accuracy of the model prediction is about 81%, indicating that the model can effectively predict a change in children's mental health status.

The model output revealed an association between specific behavioral patterns exhibited during the game (e.g., teamwork, decision-making speed) and improved mental health.

(3) Practical significance in the field of education

The application of deep learning models has shown that children's mental health can be predicted accurately by analyzing their behavior during play. This has important implications for the development of educational games and intervention strategies.

The experimental results demonstrate that the application of deep learning techniques to sports games is effective, especially in promoting children's mental health and social skills.

These findings could be used to assist educators and game developers to design games with more educational value, especially those aimed at improving children's psychological well-being and social skills.

Combining the results of quantitative and qualitative data analysis, this study confirmed the positive effects of deep-learning-enhanced sports games on children's mental health.

6. CONCLUSION

The purpose of this study was to explore the effect on children's psychological development of sports games based on deep learning. A mixed-method study design combined quantitative data (such as SCL-90 scale scores) and qualitative data (such as interviews and observation records), and applied a deep learning model to analyze the data. The results of the study showed that children who participated in deep-learning-enhanced sports games experienced significant improvements in mental health. In particular, there was a reduction the children's anxiety and depression symptoms, and their social interaction and teamwork skills were enhanced.

However, this study has two main limitations. First, the relatively small sample size may limit the general applicability of the results. Second, studies have focused primarily on short-term effects, with limited assessment of long-term effects. Future studies should consider increasing the sample size and tracking changes in children's mental health over a longer period of time.

The research findings have practical value and several application prospects. First, educators and game developers are offered valuable insights into the design of games that will promote children's mental health and social skills. Second, the application of deep learning models demonstrates a new way to assess and predict the impact of games on children's mental health, which has important implications for the development and customization of efficient educational games. Finally, this study highlights the importance of considering children's psychological development when designing games, providing new directions for future research and practice in the fields of education and mental health.

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