

The Effect of the Self-Made Marking System on Table Tennis Players Serve and Reception Interpretation

Zeng Yumin¹, Wang Pu¹, Wang Ze², Wang Zhengming^{3,*}

¹*Southern University of Science and Technology, Shenzhen, 518055, China*

²*Guangzhou Nanyang Polytechnic College, Guangzhou, 510900, China*

³*Shenzhen Technology University, Shenzhen, 518118, China*

**Corresponding Author.*

Abstract: With the rise of the sports technology industry, it has become a global trend to combine science with technology. We can monitor the movement load and confirm the correctness of the key claims through wearable devices and action identification system, in order to improve the sports performance of the players, to search and reduce the controversy of the competition. Therefore, in the fast-paced table tennis match, how to replace the traditional way of sentiment search through technology intervention is a topic worth discussing. **Objective:** To improve the accuracy of table tennis lovers serve and receiving through the self-made marking system. **Method:** Use the single test study method to record an amateur table tennis player. Table tennis marker analysis and C statistics are used to understand the strength of the relationship between the variables. **Results:** Subject to accept the correct reading rate of "table tennis marking system after intervention". The C statistical analysis results found $C=.71$, the cut-off test results $z=2.85$ ($p < .05$), reaching significant differences. **Conclusion:** The visual learning of the table tennis marking system is effective. **Conclusion:** According to the C statistics and the analysis of the critical value results, the interpretation accuracy rate is not significantly different between the tracking period and the processing period, and the intervention effect is retained. In addition, the table tennis technology ball road is many difficult To resolve with the naked eye. Therefore, it is believed that the improvement of interpretation accuracy is not only the improvement of their own skill level, but also the theoretical knowledge reserve of table tennis. The two are mutually related, which is also of great benefit to the skill level.

Keywords: Sports Technology, Sentiment Search, Accuracy

1. Introduction

The subjects of this study are female college students of National Tsinghua University, 19 years, zero ball age, no major upper or lower limb injuries within one year and have not received professional training in table tennis, and have visual teaching with the consent of the subjects. The main purpose of this study is to improve the reading accuracy of table tennis lovers serving and receiving service through the table tennis marking system.

2. Experimental Process

This study discusses the effectiveness of table tennis marking system in learning the accuracy of table tennis serve and return judgment. The most basic design in a single experimental design case is AB, ABA, or ABAB. Among them, AB is the most basic form, but AB design a single case study cannot ensure the intrinsic validity, experimental effect may be the natural case of mature or other events, so the design of the ABA add a baseline for participants back to the baseline period without intervention, if the behavior of the participants return to the state before the intervention period, can make the researchers more confident to prove the experimental effect is attributed to the intervention. Therefore, this study adopted the single subject experimental design A-B-A withdrawal design. This study did not conduct any teaching during the baseline stage, and only collected the performance data of the subjects serving and receiving reading rate when watching table tennis matches. After the baseline level is stable, the intervention stage is entered. During the intervention period, the researchers first marked the video of table tennis, and then studied the subjects by video, teaching every day

for eight consecutive days, 15 minutes each time, and then analyzed the obtained data. During the retention period, the subjects will not learn to test the effectiveness of the subjects learning about the table tennis marking system.

The self-change is a customized "table tennis labeling system" developed by the Sports Science and Technology Center of Taiwan Tsinghua University, that is, combining visual learning guidance for subjects, including table tennis technology analysis and analysis of image results, and using the obtained data to teach one-to-one interpretation learning results in the form of visual learning. According to the change, whether the subject has the learning effect after learning the table tennis marking system, that is, in the correct rate of serving and receiving, the improvement of correct interpretation indicates that the learning of the table tennis marking system is effective; otherwise, the effect is not

good, as shown in Figure 1. The interpretation accuracy is calculated by the formula (formula _ 1).

Correct rate formula: $\frac{\text{Total score for reading}}{\text{Perform the correct score}} =$
Correct rate of judgment (1)

The experiments were carried out in the indoor table tennis field, and a camera (60Hz) was set up on the sagittal surface of the ball table to record a singles match, and the complete events were captured and remitted through Movavi video editor editing software. Then tsinghua university sports science and technology center development of customized "table tennis marking system", test purpose to evaluate the subjects in table tennis interpretation ability, the system content contains forehand and backhand, ball and table tennis table tennis technology, and through the two table tennis coach mark analysis, table tennis marking system interface, as shown in Figure 2.

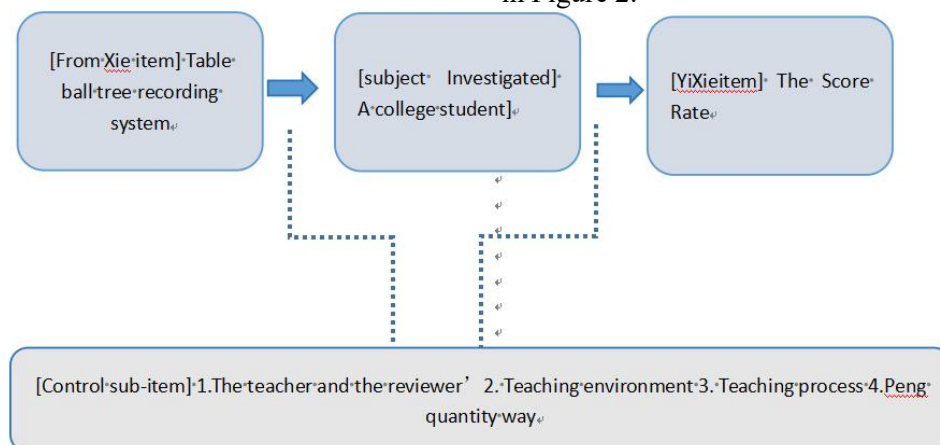


Figure 1. Study Architecture Diagram

3. Data Analysis and Processing

In this study, four master researchers were divided into two groups as co-scorer to assist in scoring and analyze the effectiveness of students progress before and after teaching intervention.

The evaluation data collected in the baseline period, intervention period and retention period are analyzed and drawn into a curve diagram. Stage change analysis was then performed. The analysis method is as follows:



Figure 2. Main Screen and Analysis Interface of the Table Tennis Marking System

In-stage change analysis: explore the level stability, level range change, trend trend, trend stability, level change and average level of

relevant data analysis during the stage.

(1) Horizontal stability: the average value of the data points in the stage is calculated, and the

average value is the horizontal line. If 80-90% of the data points in a certain stage fall within 15% of the horizontal average value, the data will be considered stable; otherwise, it is variable.

(2) Horizontal range: refers to the range of the vertical axis value of the minimum and maximum data points in the stage, which is helpful to understand the change situation of the data points during the stage.

(3) Trend trend: refers to the slope of the data path, with rise (/), decrease (\) and level

(—) Three data paths, their significance is progress (+), backward (-) and zero progress (=) three situations, in the middle division method can be used to draw the trend.

(4) Trend stability: according to the number of data points along the trend line in the stage. If more than 85% of the data points fall within the 15% range, the data can be considered stable.

(5) Level change: refers to the level change within the stage, that is, the last part of the stage and the vertical axis of the first data point straight decrease.

(6) Average level: refers to the sum of the vertical axis values of all data points in the stage to remove the total number of data points.² Inter-stage change analysis: focus on the data comparison of two adjacent stages to calculate the change between the levels, the direction and effect of the trend change and the overlap percentage of the two stages.

(7) Change between levels: refers to the difference between the first data point in the next stage in the adjacent stage, and the last data point in the previous stage. If the level change is positive, the subjects evaluation results show progress, or reverse.

(8) Direction and effect of trend change: it is used to compare the change effect of two connected stages, which may be positive, negative or unchanged, and then used to evaluate the effect of teaching intervention.

(9) Percentage overlap: refers to the data points after the two adjacent stages. The overlap ratio within the data range of the previous stage refers to the data points within the range of the previous stage divided by the total data points of the current stage and multiplied by 100%. It refers to calculate the numerical overlap range of data points between adjacent stages. A lower overlap ratio indicates a more pronounced effect of the experimental treatment.

This study is supplemented by C statistics to explain the results of the visual analysis, to test

whether the subjects progress situation has reached a significant level, in order to verify the effect of the teaching treatment. In the formula, N is the number of data points, SC is the standard deviation of the C value, and Z is the normal assigned value. This formula can be used within and between stages. As long as the data of the stage is brought into the formula, the Z-value obtained can be used as a judgment of the stability of the data. If the Z value calculated during the stage reaches a significant level, the subjects performance is not stable; during the calculation between stages, if the Z value of the baseline and intervention period reaches a significant level, the intervention effect is good.

4. Experimental Result

After the analysis of the table tennis marking system, it was learned that the intervention of the table tennis marking system improved the subjects performance in the accuracy of table tennis serve and reception. The results are shown in Figure 5, the subjects did not practice table tennis before this experiment, and the "interpretation" behavior in the baseline period was 22.2%. After the assistance of the table tennis marking system, the performance of this behavior was significantly improved, with the highest 88.2% and the lowest 31.6%, all higher than the baseline period, and the "interpretation" behavior in the processing period was 62.1%. It is known that the overlap rate between the baseline period and the processing period is 0%. Compared with the extension period, the intervention period is 78.1% during the tracking period and 100% respectively. It shows that the learning effect of the subjects in the baseline period is lower than the treatment period and the tracking period; the intervention effect of the subjects is retained. In addition, the subjects received the correct interpretation rate of "after the intervention of the table tennis marking system", and the results found that $C = .71$, the cut-off test results of $z = 2.85$ ($p < .05$), reaching a significant level, with an effective interventional response.

In the past, the information of all the contestants was collected and summarized in a traditional way, and the technical style of the contestants cannot be judged in the limited time (Zhuang Guoliang, Liu Youde, 2013). In this study, the correct interpretation rate of the case is mainly discussed on the basis of the competition video, so as to present the characteristics of the

competition. Therefore, before the visual learning method, students need to pay attention to independent learning. First of all, they need to increase the first knowledge, especially the understanding of the knowledge background is particularly important (2017, Chen Guangzhi, Zeng Ruicheng). Students learning ability affects the level of interpretation accuracy. With the improvement of interpretation accuracy, students can deal with the tactics of different players with clearer tactics in the competition. With only one study subject, the results of this study are not suitable for the evaluation of the parent group.

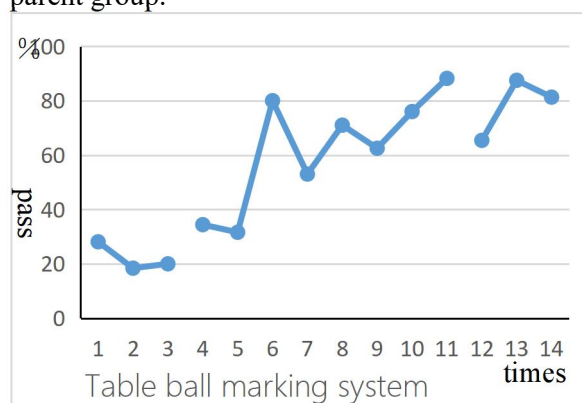


Figure 3. Correct Interpretation Rate

5. Conclusion

The subjects visual learning of the ping-pong marking system was interventional, with significant differences. The analysis of C statistics and critical value results shows that there is no obvious difference between the interpretation accuracy in the tracking period and the processing period, and the intervention effect is retained. In addition, the table tennis technology ball path is numerous and high technical requirements, it is difficult to distinguish with the naked eye. Therefore, it is believed that the improvement of interpretation accuracy is not only needs to the improvement of their own skill level, but also needs to improve the knowledge reserve of table tennis. The two are mutually related, which is also of great benefit to the skill level.

It is suggested that future studies can mark more detailed content for the requirements, such as the number of rounds, the application effect of other techniques and tactics. It is hoped that more researchers will be willing to engage in such research in the future and collect more information for the follow-up evaluation of the accuracy of the table tennis marking system.

With the improvement of the subjects table tennis level, the interpretation analysis of other balls in the table tennis competition was gradually increased. In addition, according to the level of the subjects, a variety of players can be selected for comparison. Through the classification of various competition results and more detailed analysis between each round, the performance characteristics of the players of each level can be understood, so that the coach and the players can have more effective pre-war analysis and training arrangement.

Reference

- [1] Zhang Zhenxing. Analysis of the mark of receiving attack [J]. Volleyball Coach Science, 2010, (15)
- [2] Dai Congwen. Application of Data and Image Analysis in Taiwan Junior College Mens Basketball Competition [J]. Journal of Sports of National Taiwan University, 2018, (21)
- [3] Chen Jiayu, Liu Youde. Data can speak: Discussion on the methods of ball skills and tactics [J]. Taiwan Sports Psychology News, 2010 (17)
- [4] Li Pinxuan, Ou Jie, Lin Wenbin. Exploration on the intelligence of sports technology and tactical analysis [J]. Sports Management. 2018 (40)
- [5] Chen Guangzhi, Zeng Ruicheng. Comparison of PBL and direct teaching mode on college students billiards movement skills and learning attitude [J]. Journal of Sport, 2017, (1)
- [6] You Fengyun. Modern table ball serving and receiving technology training and application [J]. Journal of Sports Knowledge, 2007, (4)
- [7] Shen Zhuya. Research on the technical training of billiards serving and receiving service [J]. Science Public Science Education, 2012, (3)
- [8] Huang Zhenhua, Lin Lihua, Xie Xuan-rong. Trend analysis of the scoring effect of technical and tactical points in the table tennis competition stage [J]. Yadong Journal, 2010, (30)
- [9] Xu Minghua, Lin Jianhao, Wu Decheng. The Importance and Training methods of key ball in table ball games- -Take Zhuang Zhiyuan of the 2012 London Olympic Games as an example [J]. Sports Coaching Science, 2015, (38)

- [10] Wu Yufeng, Ye Shaowei. The Development strategy of the National Movement in the Era of Big Data [J]. Sports Management, 2016, (33)
- [11] Wang Weiyao, Zhang Kaixiang, Chen Tingfeng, etc. Badminton Coach AI: Badminton tournament information analysis platform based on deep learning [J]. Journal of Sport, 2020, (2)
- [12] CAI Junming, Li Qiulan. Application of deep learning YOLOv3 Research on the accuracy of improving the accuracy of detecting and identifying players in badminton events [J]. New Knowledge of the National Education Association, 2019, (1)
- [13] Vieira, C., Parsons, P., & Byrd, V. (2018). Visual learning analytics of educational data: A systematic literature review and research agenda. *Computers & Education*, 122, 119-135.
- [14] Li, W., Wang, L., Li, W., Agustsson, E., & Van Gool, L. (2017). Webvision database: Visual learning and understanding from web data. arXiv preprint arXiv:1708.02862.
- [15] Jastorff, J., Kourtzi, Z., & Giese, M. A. (2009). Visual learning shapes the processing of complex movement stimuli in the human brain. *Journal of Neuroscience*, 29(44), 14026-14038.
- [16] Hughes, M., & Franks, I. M. (2004). Notational analysis—a review of the literature. *Notational analysis of sport*, 71-116.
- [17] Bischoff, M., Zentgraf, K., Lorey, B., Pilgramm, S., Balser, N., Baumgartner, E., ... & Munzert, J. (2012). Motor familiarity: Brain activation when watching kinematic displays of ones own movements. *Neuropsychologia*, 50(8), 2085-2092.
- [18] Lam, W. K., Maxwell, J. P., & Masters, R. (2009). Analogy learning and the performance of motor skills under pressure. *Journal of Sport and Exercise Psychology*, 31(3), 337-357.
- [19] Liu, C., Huang, Q., Jiang, S., Xing, L., Ye, Q., & Gao, W. (2009). A framework for flexible summarization of racquet sports video using multiple modalities. *Computer Vision and Image Understanding*, 113(3), 415-424.
- [20] Sève, C., Saury, J., Leblanc, S., & Durand, M. (2005). Course-of-action theory in table tennis: A qualitative analysis of the knowledge used by three elite players during matches. *European Review of Applied Psychology*, 55(3), 145-155.
- [21] Williams, A. M., Davids, K., Burwitz, L., & Williams, J. G. (1994). Visual search strategies in experienced and inexperienced soccer players. *Research Quarterly for Exercise and Sport*, 65(2), 127-135.
- [22] Yang, B., Chang, Z., & Chen, Y. (2021). Falling-point recognition and scoring algorithm in table tennis using dual-channel target motion detection. *Journal of Healthcare Engineering*, 2021, 552998 1 .
- [23] Du, M., & Yuan, X. (2021). A survey of competitive sports data visualization and visual analysis. *Journal of Visualization*, 24(1), 47-67.