Neurotracker Training to Improve The Archery Athlete Concentration

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Article Info

Abstract

Neurotracker is a 3D technology with Multiple Object Tracking (MOT). This technology has not been developed in Indonesia. Meanwhile, developed countries have implemented this technology in sport training, including in archery sport. In archery sport, the athletes are required to concentrate every time they perform a technique and to be fast and accurate in making a decision when aiming and releasing the arrows. The problem usually occurs during shooting is that the athlete doubts in aiming and releasing the arrows, thus the shooting result does not hit the target. It is caused by the athlete's doubt and the lack of concentration. To overcome the problem, a neurotracker training is important to be conducted in every training process to improve the athletes' concentration. The method used in this study was an experimental method. The samples were 20 persons chosen in a non-random sampling. The subjects were divided into two groups through a random assignment, thus the number of subject in each group was ten persons. The instrument to measure the concentration was the Concentration Grid Test. The design of the study was pretest-posttest control group design. To analyze the data, t-test was used. The result of the study showed that (1) there was a significant effect of the NeuroTracker training on the improvement of the archery athlete's concentration, (2) there was a significant effect of conventional training on the improvement of archery athlete's concentration, (3) there was a significant difference of effect between the NeuroTracker training and conventional training in the improvement of the archery athlete's concentration. The NeuroTracker training was better than a conventional training in increasing the archery athlete's concentration. It is suggested that the archery trainers implement the NeuroTracker technology in the training process as it could improve the concentration of the archery athletes.

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INTRODUCTION

The highest achievement is affected by various factors (Heinen, 2011). The psychological ability is an important part to gain the highest achievement (Weinberg & Gould, 2007). The athletes holding psychological abilities will have a maturity in facing challenges in completing their duties in various situations, including during training and during competition. Athlete's psychological maturation is reflected on their ability in controlling various problems, facing various challenges, and having a self-confidence and commitment in doing their duties (Komarudin, 2016).

Archery athletes, in the competition process, will always face various obstacles causing the decrease in archery athlete performances. The obstacles include other teammates, competitors, coaches, and/or managers, the presence of people you want to impress, spectators, crying children, mobile phones, family or relationship problems, media-photographers journalists, video cameras, announcers, mistakes, unexpected high performance, unfavorable weather conditions, changes in competition schedules, etc. (Lee & De Bondt, 2009). The obstacles will affect the psychological condition, such as the ability to focus and disruption in the process flow. It gets in the way of the attention that you need to apply to uphold excellent technique. This not only causes stress, but also consumes mental energy that is better applied elsewhere (Lee & De Bondt, 2009). Therefore, archery athletes are required to have a psychological maturity to enable them to control their problems, including in controlling their body, mind, decision making, and a precise shooting. The condition cannot be automatically acquired by the archery athletes if it is not supported by a good physical condition, skill, intellectuality, and the quality of central nerve system to control the complexs duties (Drust, 2013).

The implementation of technology in a psychological training especially for improving athletes' concentration is rarely conducted, mostly neglected. In advanced countries, such as European countries, the training technology to increase the performance, especially psychological performance, has been rapidly developed, starting from the application of biofeedback, Life Kinetik, NeuroTracker, and so on. NeuroTracker technology is a research product from Neuro-Science as a new technology to improve the athlete's performance.

In Indonesia, NeuroTracker has not been popular among the athletes and coaches, although this technology could improve an athlete's performance, especially in improving concentration, consistence, and performance during shooting.

Coaches, in the training process, still use conventional methods, such as training by using a clock by following the movement of the second hand, using candles for focus training, doing meditation, and using imagery without technology utilization. Meanwhile, there is a target requiring serenity, concentration, and precision in making a decision to result in a good performance. This condition is contradictive with the real situation in the field, where the athletes are demanded to give the best performance, while their psychological aspects are neglected, thus the target cannot be achieved well (Weinberg & Gould, 2007).

This condition creates a wide gap in the training quality between Indonesia and advanced countries, such as Korea, thus it is understandable if European countries gained two world records in Asian Games from 50 meter (144 arrows) mixed team compound. Chaewon and Choi Yonghee created a new record after gaining 1412 points. They created a world record over Jody Vermeulen and Mike Schloesser in the World Archery Championship 2018 in Berlin. Jody Vermeulen and Mike Schloesser gained 1410 points at that time. The interesting achievement occurred in 70 meter (144 arrows) mixed recurve team. Kang Chae Young and Oh Jin Hyek gained 1364 points, renewing the world record over Ukraine team, Anatasia Pavlova and Markiyan Ivashko, created in the Europe Grand Prix Rangking Event 2018 in Bulgaria with 1343 points (Setyawatie, 2018).

The efforts to align the archery sport training quality in Indonesia with the advanced countries is surely hard. It is caused by the limitation of a country. But a concrete effort could be conducted by improving important components contributing to the achievement improvement, including improving the psychological condition of the athletes by using NeuroTracker technology. The development and application of this technology in archery sport in Indonesia has not been implemented, while other countries have been familiar with this technology. If we are not proactive and innovative, archery sport wil continuously be left behind

and cannot compete with other countries in the world. NeuroTracker technology is a tool combining some of main components, including awareness, attention, and focus in a simple but challenging task. The many use of this technology is aimed at supporting the athlete's performance. Technology is beneficial for improving neuroplasticity, the brains incredible ability to adapt and change itself to better respond to performance demands (Martinez, 2019).

A research related to NeuroTracker technology argues that NeuroTracker training significantly enhances attention, working memory, and information processing speed and also lead to positive changes in neuroelectric brain function. (Brendan, 2014). Moen, et al., (2018) state that a research on 60 elite athletes from various sport branches, such as martial arts (boxing and wrestling), handball, soccer, biathlon, orienteering, alpine skiing, and paralympic sports (sled hockey, badminton, and table tennis), show that there was no significant impact on the excecutive function of some sport branches. The result of discussion concludes the importance of the specific training utilizing NeuroTracker 3D Multiple Object Tracking (MOT) technology. NeuroTracker is a tool designed to help you overcome challenges with increased alertness, awareness and attention for performing well on a daily basis (Faubert, 2018).

The result of research convinces the researcher that NeuroTracker, specifically, could improve psychological aspect, including the athlete's concentration. Therefore, researchers were interested to further study and examine this technology in the archery sport training process to improve the athlete's concentration. The purpose of this research was to further study the effect of NeuroTracker training on the archery athlete's concentration improvement and to study the difference between the NeuroTracker training and conventional training on the improvement of the concentration of archery athletes.

METHODS

The method used in this study was experimental method, where researchers actively manipulated the independent variable (Fraenkel, et all. 2012). In the experiment process, the researchers aimed to find out the effect of manipulation on the dependen variable chang-

es. In the process of experiment, the researchers tried to pilot training utilizing NeuroTracker technology on the concentration and shooting ability improvements of archery athletes. The esperiment was aimed to examine the utilization of NeuroTracker technology in the concentration and shooting ability of archery athletes.

The treatment in this research was given to the experimental group, the group that received training utilizing NeuroTracker technology. Meanwhile, control group was given a conventional training that was generally conducted in the archery training in archery club of Universitas Pendidikan Indonesai with the regular program set earlier. The treatment was given in 12 meetings, three times a week, including Monday, Wendesday, and Friday. The treatment refered to the previous research stating that the experimental group trained on the 3D-MOT twice a week for 5weeks (Aidan Moran, Mark Campbell & Danila Ranieri, 2018). NeuroTracker training was conducted for one core session training, where each training session consisted of 20 times of trial (Jean, 2018).

In line with the design of the research, before giving treatments, a pretest was administered related to dependent variables, including concentration and shooting ability tests. The purpose of the pretest was to find out the initial ability of the archery athletes before the treatment with training utilizing NeuroTracker. The treatment was given systematically based on the program in the NeuroTracker training. When the treatment was completed on both groups, the post test was conducted on the dependent variable to examine if there was an improvement of the average score related to concentration and shooting ability of archery athletes.

The subjects of this research were all archery athletes in student archery club in Universitas Pendidikan Indonesia, consisting of 40 people. Subjects involved in this study were 20 people, including 14 males and 6 females, aged 19-21 on average, taken with the non random sampling (purposive sampling). The consideration was that the subject had acquired shooting ability and had competed in various archery competitions. Furthermore, the subjects were divided into two groups with a random assignment technique. The experiment group consisted of ten persons as well as the control group. The experimental group received treatment utilizing NeuroTracker training, while the conventional group

received a general training generally conducted in the training process of the archery club.

The procedure of this research was conducted as follows. The athletes, in the treatment process, were instructed to complete 12 training sessions for four weeks. The NeuroTracker was placed in a training room. Every athlete was trained individually. Relevant with the program and the instruction set in the Neuro-Tracker Manual, the training was conducted in the quiet and relatively dark place, as too many lighting will distruct the quality of the camera in capturing movements. Every athlete wore 3D glasses to activate the sharp perception of vision on TV. Athletes were asked to sit upright on a chair placed in front of a 3D 50 inches (LG) TV with 1.33m of distance.

NeuroTracker is designed to offer various different trainings adjusted to the individual ability. In this research, the researchers focused on the core session of training, where each session was conducted 20 repetitions for 8 seconds in a training meeting. The difficulty in NeuroTracker training was the speed of the target movement that had been adjusted to the NeuroTracker program. The instruction for the athletes in conducting NeuroTracker training is explained by Vartanian, Coady, Blackler (2016) that four targets will light up red, then return to yellow. Pay attention to the four targets when they are moving for 8 seconds. In the end of the 8 second repetition, identify the four targets. If the athlete identified those four targets correctly, the speed will increase. If the athlete made a mistake, the speed will decrease. In the end of the 20 repetition, the athlete will get the final score for all sessions.

Meanwhile, in the conventional group, the athletes were given general training during the routine training, including warming up, shadow shooting training without arc, concentration training using flaming candles, and staring and following the clockwise in second, meditation training, and imagery training followed by shooting in 10m, 15m, 20m, 25m, and 30m of distance.

To gain data, researchers used a correct instrument, thus the gained data were the data resulted from the valid and reliable instrument. The instrument to measure the concentration of archery athletes was CGT (Concentration Grid Test) (Harris & Harris, 1984; Williams, 1993). This instrument had reliability (test-retest) result tested by product moment correlation of r = 0.79 (p < 0.05). The equipments needed to conduct the test included: 1) a room, 2) stationary, 3) Concentration Grid Test sheet, and 4) stop watch.

The design in this study employed the pretest-posttest control group design (Creswell, 2013). The design included two independent variables and one dependent variable. The independent variables were the training using NeuroTracker (X1) training and conventional training (X2). The dependent variable was the concentration ability of the archery athletes (Y1).

The data analysis technique used in this research was the parametric statistical analysis. In this research, two independent variables and one dependent variable were included. The independent variables in this research were the training using NeuroTracker (X1) and conventional training (X2). The dependent variable of the research was the concentration ability of the archery athletes (Y1). The data analysis technique used in this study was the t-test using the SPSS version 21 for windows program (Santoso, 2013).

RESULT

Data obtained from the measurement process were then analysed by statistical approach. The data analysed in this study were the concentration of archery athlete data. Before the test was administered, the post test was conducted on the variable. The researchers conducted a pre test to the two groups of sample to examine the score increase as the effect of the NeuroTracker training treatment on both dependent variables. When the treatment was completed, a post test was conducted to gain concentration data of the archery athletes.

The result of the mean of the pre-test and post test, standard deviation, gain score, and the concentration variable of archery athletes receiving NeuroTracker training and conventional training can be seen in Figure 1. Data in Figure 1 show that concentration ability of the archery athletes displays score improvement from the pre-test to the post test shown in the gain score. The mean of pre-test score of the concentration ability of the NeuroTracker training was 11.200, while the post test mean was 19.700, with the gain score 8.500. Meanwhile, the conventional group gained mean score

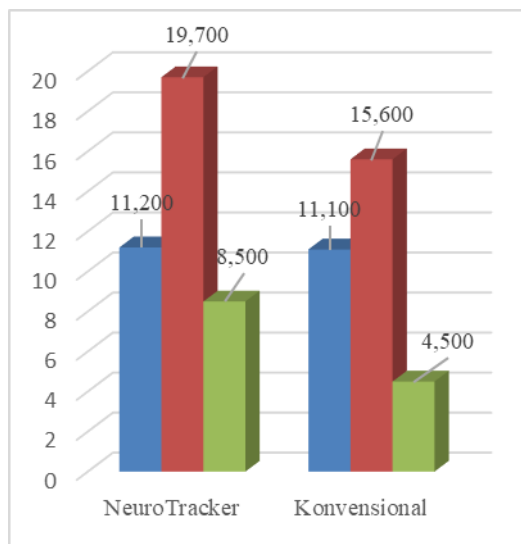11.100 for pre-test and 15.600 for post test, with gain score 4.500.

Figure 1. Calculation result of mean, standard deviation, gain score, and archery athlete concentration

The data analysis technique of this research used parametric statistics analysis, as the gain of the concentration variable after the normality and homogeneity tests was (p) > 0.05, which means that the concentration data of the experimental and control group were normally distributed and homogenous. Therefore, the statistical test used was the parametric test named t-test. To find out the increase of mean of the pre test and post test on the concentration variable trained by NeuroTracker training and conventional training, the Paired t-test was conducted. The result of analysis shows that the concentration variable of the experimental group was t-calculated -21.177 with (p) 0.000 < 0.025; of the control group was t-calculated -9.429 with (p) 0.000 < 0,025. Therefore, it concludes that there was a significant difference between the pre-test and the post-test on the concentration variable of the group with NeuroTracker training. According to the result of analysis, it concludes that there was a significant effect of NeuroTracker training and conventional training in the archery athlete concentration.

Furthermore, to find out the effect difference between the NeuroTracker training and the conventional training, the Independent t-test was conducted. The result of the test showed that t calculated was 6.414,

while (p) 0,000 < a 0.025. Therefore, it concludes that there was a significant effect difference between the NeuroTracker training and conventional training on the archery athlete concentration improvement. According to the mean of the concentration variable, the training utilized NeuroTracker technology was better than the conventional training on the archery athlete concentration improvement.

DISCUSSION

To discuss the finding of the study, the researchers studied some literatures theoretically according to the previous research. The training for improving the athlete's performance does not only emphasize on the physical aspects (Oemosegard, 2001), especially training emphasizing brain training, specifically in the hippocampus area (Lutz, 2017). Similar opinion is also explained by William (2015) that sports specialists are aware that achieving success isn't all physical–it's also mental too. To increase athletic performance, training the brain is also important. Psychological training, in the training process and competition, is important because competition 95% depends on psychological factor (Townsend, 2008). Psychlogical factor, such as stress assisted by anxiety will have impacts on the intellectual function, thus the performance will full of awry, doubt, and inaccuracy (Setyobroto, 2001). Therefore, psychological problems are barriers that should be concerned in the training process so that the athletes could show their potential that contributes to their performance.

The finding of this research shows that there was a significant effect of the NeuroTracker training on the concentration improvement of archery athletes. This finding is strengthen by the statement that NeuroTracker is a part of psychological training that trains our brain that is able to improve the neuroplasticity. NeuroTracker also trains our brain to adapt in responding work demands. In structure, our brain will restore its function to do a required tasks efficiently. Castonguay (2015) explains that NeuroTracker brings the brain to rewire itself, thus it performs the tasks more efficiently.

In sport psychological research, it is explained that attention and concentration are important componets to improve the athlete's performance (Mann, Williams,

Ward, & Janelle, 2007). Research related to perceptual-cognitive skill has a potential in improving the athlete's performance (Appelbaum & Erickson, 2016). Besides, perceptual-cognitive skill training has a potential on the excecutive function of brain (Owen, et al., 2010). One of perceptual-cognitive skill trainings is training using NeuroTracker. NeuroTracker is a 3D, perceptual-cognitive training system that improves on-field performance for all levels of athletes. The software enhances critical abilities, including situational awareness, decision-making speed, visual processing bandwidth, and sustained concentration (Jean, 2018). Thus, Neuro-Tracker is a perceptual-cognitive skill in a 3D form that enables athlete achievements on all levels. The aspect that can be trained by NeuroTracker is the critical abilities, including speed in taking decision, visual processing bandwidth, situational awareness, and sustained concentration.

In the archery sport, this technology is crucial as the athletes should focus on the series of archery movement techniques begins from stance to aiming and release the arrows. In the aiming and release stages, the athletes are required to be brave in taking decision quickly, precisely, and accurately. Moreover, an arc is completed with a kliker that the athlete should quickly release the arrow. In the http://www.optikiq.com., Optik (2019), it is explained that effective decision making skills become vital, and as the level of performance rises, the demands increase, pushing the individual to the threshold of their cognitive capacity. The brain is plastic and able to adapt to new demands with training that make it possible for a person's cognitive processing thresholds to be upraised, leading to increased ability to deal with the high-pressure demands of the competitive world. The opinion emphasizes that the effective decision making is important to increase the performance in the higher demand that reinforces a person to reach the cognition capacity. The brain plasticity will be able to adapt with new demands in the training process that enables the cognition process to increase above the threshold and improve the ability in meeting the requirement of a competitive world.

The attention and concentration are relized abilities. The disruption of attention causes the loss of awareness significantly. It even further causes the loss of focus in the critical time during a big event. Neuro-Tracker excels at training attention as it amplifies the demands and the pressure of this skill, resulting in failure the very instant there is a lapse. Mastery of several attention forms are essential for performing at the highest levels, each of which NeuroTracker trains in a specialized way (Castonguay, 2015). In the NeuroTracker training, the athletes are trained in the ability to track objects that is directly correlated to the anticipatory respons time and rapid decision making in an athlete. A quick tracking speed is highly important in almost all sports. In a game, athletes need to hold an increase ability in recognizing the game situation, effective anticipate future events, and take the best possible decision while avoiding costly mistakes (Mangine, et al., 2014; in Caroline, et al., 2018). Elite athletes have an ability to make more efficient eye movements and perform better on measures of attention (Appelbaum & Erickson, 2018).

CONCLUSION

According to the result of the data analysis of this research, the researchers conclude that there was a significant effect of the NeuroTracker training on the concentration improvement of archery athletes; there was a significant effect of the conventional training on the archery athlete concentration improvement; there was a significant effect difference between NeuroTracker training and conventional training on the archery athlete concentration improvement. According to the gained mean, NeuroTracker training was better than conventional training on improving the archery athlete concentration. For that reason, the researchers suggest that archery trainers and athletes to shift the psychological training into the utilization of NeuroTracker technology to train the athlete's concentration, as this technology is better than the generally used training method.

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REFERENCES

Castonguay, Jean. (2015). NeuroTraining Certification Packet. Athletics, May 2015. President and Chief Executive Officer CogniSens, Inc.

Chin, M. K., Wong, A. S., So, R. C., Siu, O. T., Steininger, K., & Lo, D. T. (1995). Sport specific fitness testing of elite badminton players. British journal of sports medicine, 29(3), 153-157.

Dynamic Chiropractic & Sport Therapy Center. (2018). The most scientifically validated cognitive training tool in sports. (online). Retrieved fromhttps://dynamicsteinbach.com/services/neurotracker/.

Erickson, G. (2018). Sports vision training: A review of the state-of-the-art in digital training techniques. International Review of Sport and Exercise Psychology, 11(1), 160-189.

Exercise Science College of Education (2019). Neurotracker Testing and Training. (online). Retrieved from https://www.usf.edu/education/ areas-of-study/ exercise science/servic eees/neurotracker.aspx.

Fraenkel, J., Norman Wallen, & Helen Hyun. (2012). How to Design and Evaluate Research in Education. McGraw-Hill Humanities. ISBN: 9780078097850. p. 220-243.

John W. Creswell. (2013). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches Fourth Edition. SAGE Publications, Inc. ISBN: 9781452226095. p. 237-242.

Komarudin. (2016). Latihan Mental dalam Olahraga Kompetitif. Rosdakarya. ISBN: 978-979-692-147-8 p. 65-67.

Lee, Kisik, et all (2009). Total Archery Inside The Archer. Astra LLC, ISBN: 9780982426500. p. 163-164.

Lutz. (2017). Perform better with life kinetik: brain-based training model for elite performance. US Youth Soccer Workshop. Los Angeles. (online). Retrieved from http://soccer-coaches.com.cloud8-vm179.de nserv er.de/life-kinetik with -horst-lutz-at-the-nscaaconvention/.

Mann, D. T., Williams, A. M., Ward, P., & Janelle, C. M. (2007). Perceptual-cognitive expertise in sport: A meta-analysis. Journal of Sport and Exercise Psychology, 29(4), 457-478.

Moen, F., Firing, K., & Wells, A. (2016). The effects of attention training techniques on stress and performance in sports. International Journal of Applied Sports Sciences, 28(2).

Moen, F., Hrozanova, M., & Stiles, T. (2018). The effects of perceptual-cognitive training with Neurotracker on executive brain functions among elite athletes. Cogent Psychology, 5(1), 1544105.

Moran, A., Campbell, M., & Ranieri, D. (2018). Implications of eye tracking technology for applied sport psychology. Journal of Sport Psychology in Action, 9(4), 249-259.

Neuro Tracker Organizaton. (2018). Benefit "Using Science to Boost Your Mental Performance". Retrieved from (web) https://neurotracker.net/benefits/.

Optik, IQ. (2019). Training Attention on Multiple Levels. (online). Retrieved from http://www.optikiq.com.

Owen, A. M., Hampshire, A., Grahn, J. A., Stenton, R., Dajani, S., Burns, A. S., ... & Ballard, C. G. (2010). Putting brain training to the test. Nature, 465(7299), 775-778.

Parsons, B., Magill, T., Boucher, A., Zhang, M., Zogbo, K., Bérubé, S., ... & Faubert, J. (2016). Enhancing cognitive function using perceptual-cognitive training. Clinical EEG and neuroscience, 47(1), 37-47.

Santoso, S. (2013). Menguasai SPSS 21 di era informasi. Jakarta: Elex Media Komputindo.p. 86-91.

Setyobroto, Sudibyo. (2001). Psikologi Olahraga. Jakarta: Anam Kosong Anam (A.K.A). p. 42.

Setiawatie, Wina. (2018). Panahan dan Menembak Pecahkan Rekor Dunia Terbanyak di Asian Games 2018. (online). Retrieved from https://www.pikiranrakyat.com/olahraga/pr-01300669/panahan-dan mene m bak-pecahkan-reko r-dunia-terbanyak-di-asian-games-2018-429376.

Townsend, C. R., Uhlmann, S. S., & Matthaei, C. D. (2008). Individual and combined responses of stream ecosystems to multiple stressors. Journal of Applied Ecology, 45(6), 1810-1819.

Tran, J., & Gallagher Poehls, C. (2018). NeuroTracker Cognitive Function and its Relationship to GPA in College Students.

Vartanian, O., Coady, L., & Blackler, K. (2016). 3D multiple object tracking boosts working memory span: Implications for cognitive training in military populations. Military Psychology, 28(5), 353-360.

Weinberg, R. S, & Gould, D, (2007). Foundations of Sport and Exercise Psychology. United States: Human Kinetics. ISBN: 9780736086417. p. 2 -5.

William, Jean. (2015). Applied Sport Psychology Personal Growth to Peak Performance. McGraw-Hill Education ISBN: 9789814577496. p. 260-270.