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EFFECT OF HIGH INTENSITY FUNCTIONAL WITH STRATEGY SPORTS TRAINING ON COGNITIVE PERFORMANCE FOR PHYSICAL EDUCATION ACHIEVEMENT IN HIGH SCHOOL STUDENTS

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

Study purpose. This research aims to develop cognitive performance on the success of sports skills in physical education in Buriram Province.

Materials and methods. The sample group of 80 people was divided into 2 groups of 40 people each. The control group was taught a regular strategy of handball instruction. The experimental group was taught a strategy of handball instruction with high-intensity functional training. Both groups were taught for 1 hour per week according to the normal teaching schedule of the school for a period of 8 weeks. All students were assessed by a computerized cognitive test battery and Sports skills achievement test in pre- and post-experimental. Analysis of the research data was performed by testing differences between the groups using the parametric and non-parametric statistics.

Results. After 8 weeks of the experiment, analysis of the difference between the experimental group and the control group in the experimental data was carried out showing that the cognitive performance in terms of attention, executive function, cognitive flexibility, and working memory takes less time in the experimental group than in the control group, including Sports skills achievement scores in the test where the experimental group had more scores than the control group, which is statistically significant at .05.

Conclusions. High-intensity functional with strategy sports training program in physical education class can develop cognitive performance in terms of attention, executive functions, cognitive flexibility, and working memory in high school students.

Keywords: cognitive performance, achievement, sports skill, physical education.

Introduction

Cognitive performance is related to the highest sporting ability, consisting of 1) Attention, 2) Inhibition control, 3) Working memory, 4) Cognitive flexibility, 5) Creativity, 6) Information processing speed, and 7) Spatial ability (Belling & Ward, 2015; Vestberg et al., 2017; Woo & Yongtawee, 2018). In addition, sports ability does not only use strength to express abilities. However, also found that one of the stages of sports skills expression must also go through the brain processing process for the muscles to move systematically (Schmidt et al., 20016). Therefore, it will be able to develop learners to achieve sports expertise and success in physical education (Yongtawee et al., 2019).

Training for developing cognitive performance, when separated by composition, found that High-Intensity Interval Training can develop Cognitive flexibility (Mekari et al., 2020) and Inhibition (Kao et al., 2018; Sugimoto et al., 2020). Strategy Sports Training with High Intensity Functional Training can develop Spatial ability (Moreau, 2012; Ben-Zeev & Okun, 2021), Working memory (Zach & Shalom, 2016; Wilke, 2020), and Information processing (Audiffren et al., 2008; Lotfi et al., 2020).

At the same time, the basic education core curriculum of the Health and Physical Education Learning Group in Thailand has set indicators and learning subjects to be necessary, consisting of movement, exercise, gaming, Thai sports, and international sports. Focus on allowing learners to learn about various forms of movement. Learners must participate in physical and sports activities, both individual and team types, Thai and international. Compliance with

rules and agreements in participating in physical activities and sports activities, as well as being kind to athletes by requiring teaching 1 day, 1 hour per day (Ministry of Education, 2008).

Nevertheless, There is rarely focus on the development of cognitive performance in learners. cognitive performance is necessary for physical education in sports ability expression by using a systematic thinking process to make decisions and act in various situations. It can also be extended to sports talent. This study aims to develop cognitive performance for physical education achievement in high school students.

Materials and methods

Study participants

80 high school students in Krasang Pittayakom School were selected from a cluster random sampling. Participants were divided into two groups by a table to determine the sample size of Cohen (Cohen, 2013). Determine alpha values at the statistically significant level of 0.05, the effect size at 0.70, and the power of the test at 0.85, with 38 students per group, two groups totaling 76 students. Furthermore, to prevent mortality in participants, 4 students were added, a total of 80 students, 40 students per group as follows:

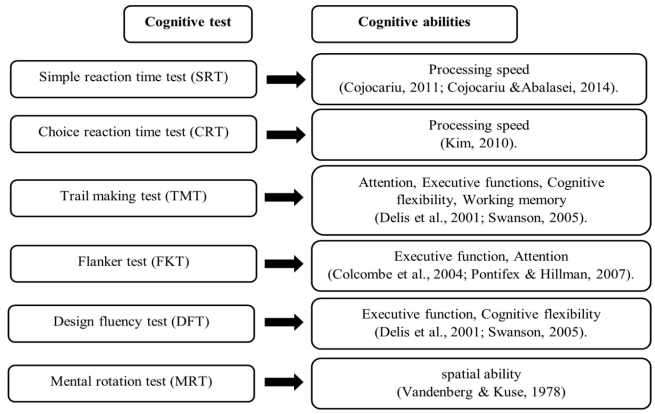

Fig. 1. Cognitive performance test

The control group received regular strategy of handball instruction. The experimental group received a strategy of handball instruction with high-intensity functional training. Criteria for inclusion of research required the participants to follow the entire program without any absence and voluntarily participate in research. All participants signed the consent form to participate in the research.

Table 1. Training program

Stage	Duration	Activity
Preparation	10 minutes	13 Dynamic warm-ups, 20 meters for each position. • High knee walk • Leg cradle • Walking heel to butt • Walking heel-up to butt with forward lean • Backward lunges walk with hamstring stretch • Backward straight-leg deadlift walks • High knee run • Butt kick • Straight leg walks • Straight leg skip • Backpedal • Backward run
Explanation and demonstration	5 minutes	The teacher explained with a demonstration of strategy game practice in handball.
Drills and practice	15 minutes	Students practiced handball strategy gameplay.
Application	20 minutes	Students rest for 5 minutes after completing handball strategy gameplay. After that, start practiced high-intensity training, consisting of as follows • Squat • Single-leg squat • Forward lunge • Side lunge • Backward lunge • Push up • Bird dog • Shoulder tap • Two-leg deadlift • Single-leg deadlift High-intensity functional training program 10 exercises, 17 sequences of exercises, using about 35 seconds, resting 10 seconds, repeating 20 rounds, totaling 15 minutes. Determine the intensity with the speed of the music rhythm 140-155 beats per minute by increasing the intensity level 5 times per minute every 2 weeks.
Conclusion	10 minutes	The teacher conducted a teaching summary together with static stretching.

Human research ethics

The research had been approved by the committee for the research ethics of Buriram Rajabhat University. The certificate issued was BRU: -rdi 002 (002/2566).

Study organization

The Quasi-experimental research design with two groups was designed to compare the effect of regular strategy games and strategy games with high-intensity functional training of handball instruction on cognitive performance for 8 weeks, 1 day per week, and 1 hour per day.

Measurement

The cognitive performance that affects physical education success test was divided into two tests as follows:

1. A computerized cognitive test battery was developed by the Department of Physical Education (Yongtawee et al., 2019), which modify from the previous study in Figure 1.
2. Sports skills achievement test in physical education courses (Handball sports) according to the basic education core curriculum of the Health and Physical Education Learning Group (Ministry of Education, 2008).

Procedure

Both groups received a cognitive performance and handball skills achievement test before training. After that, the experimental group began training according to Strategy Games with High-Intensity Functional Training of Handball instruction, as shown in Table 1. While as the control group began with regular strategy games training in handball instruction. At the end of 8 weeks, participants in both groups were repeatedly tested as before the research.

Statistical analysis

Quantitative data were tested for normal distribution of cognitive performance and sports skills achievement by Shapiro-Wilk method. When found that 1) Normal distribution data, Analyze the difference between 2 groups by independent t-test and within the group between before and after 8 weeks of training by dependent t-test. 2) Non-normal distribution data, Analyze the difference between 2 groups by Mann-Whitney U Test and within the group between before and 8 weeks of training with Wilcoxon Sign Rank Test at the significant level .05 by SPSS 23.0 (SPSS Inc. Released 2015. IBM SPSS Statistics for Windows, Version 23.0 Armonk, NY: IBM Corp.).

Results

The characteristic data for the participants in control and experimental groups were shown in Table 2.

Table 2. Characteristic data of the participants

Parameter	Control group (n = 40)	Experimental group (n = 40)
	Mean ± SD	Mean ± SD
Age (year)	17.78 ± 0.48	17.95 ± 0.71
Height (cm)	168.80 ± 8.22	171.28 ± 5.71
Bodyweight (kg)	59.85 ± 8.29	63.05 ± 10.49
BMI (kg/cm^2)	17.70 ± 2.02	18.36 ± 2.70

Cognitive performance

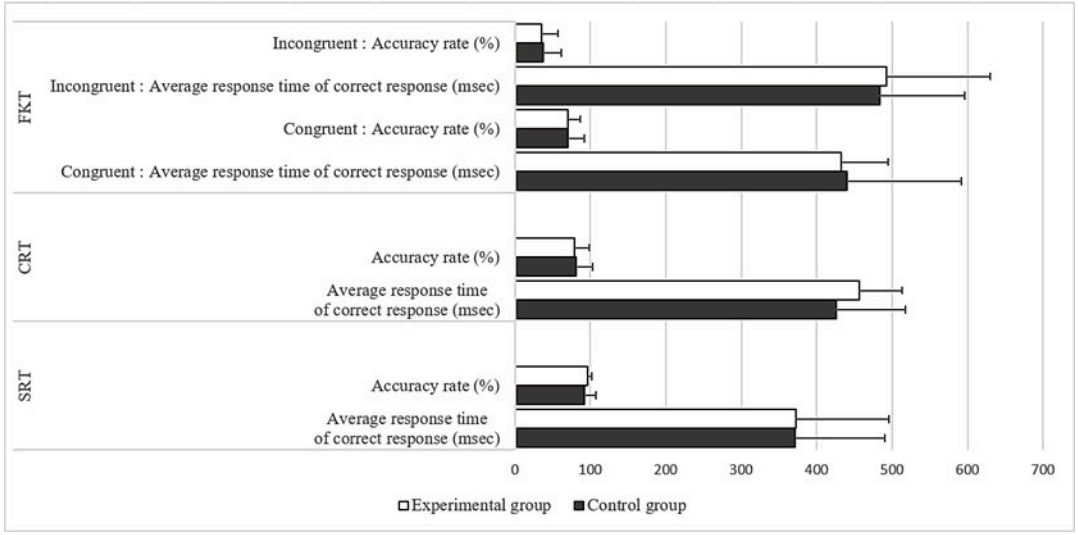

Fig. 2. In the pre-test: SRT, CRT, and FKT were no differences between the control and experimental groups, which were analyzed by the Mann-Whitney U test. At the same time, FKT (Incongruent: Accuracy rate) was analyzed by independent t-test

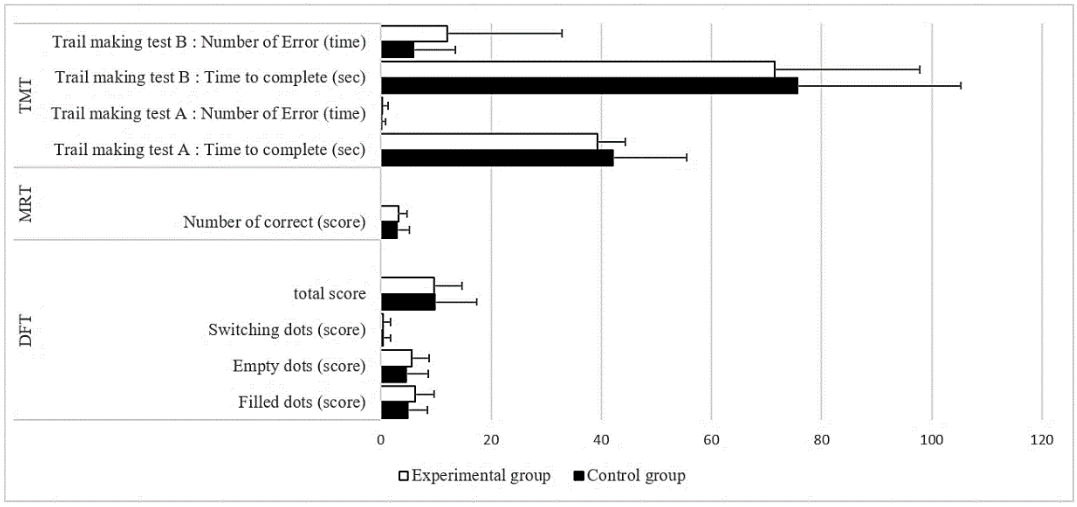

Fig. 3. In the pre-test: TMT, MRT, and DFT were no differences between the control and experimental groups, which were analyzed by the Mann-Whitney U test

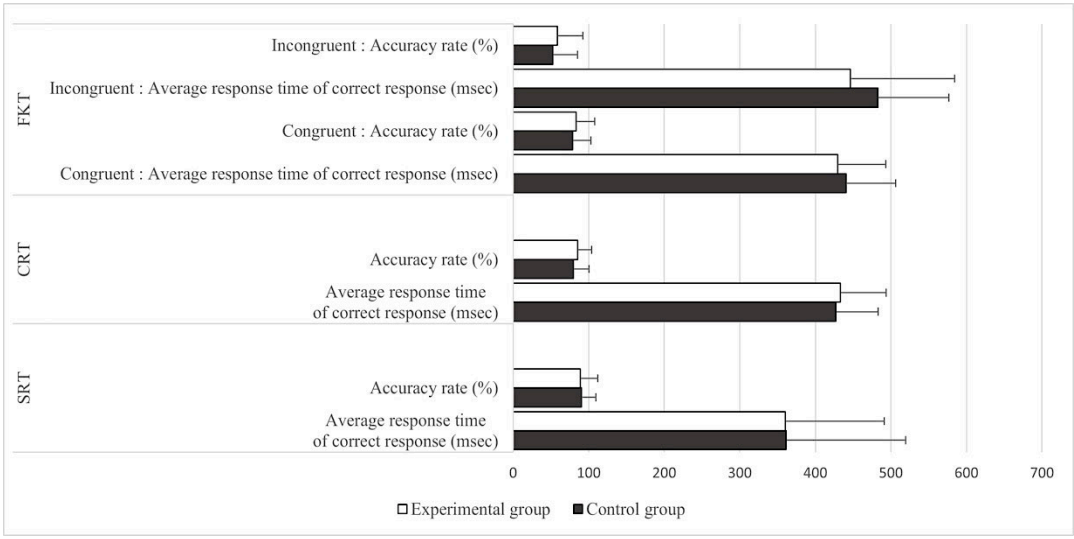

Fig. 4. In the post-test: SRT, CRT, and FKT were no differences between the control and experimental groups, which were analyzed by the Mann-Whitney U test

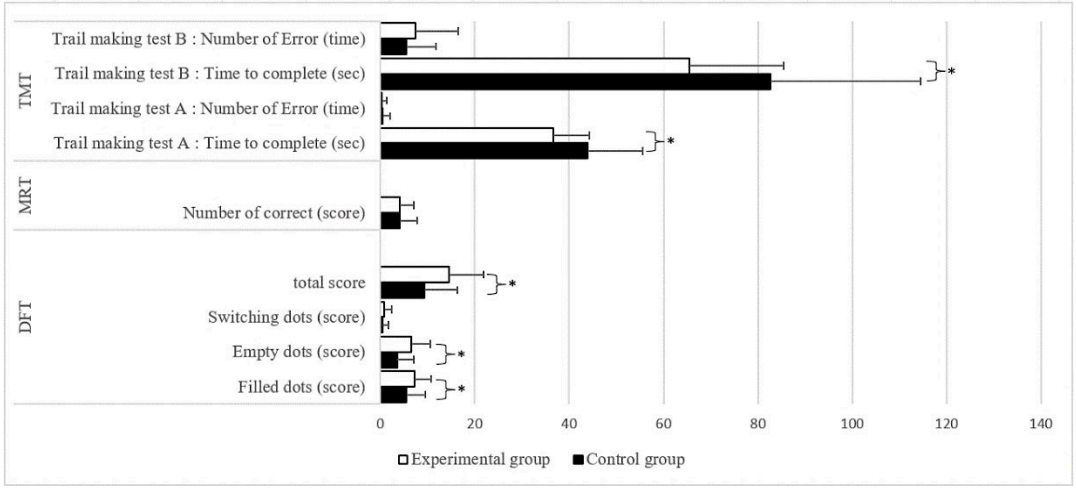

Fig. 5. In the post-test: TMT (Trail making tests B and A: Time to complete), and DFT (Filled dots and empty dots) were differences between the control and experimental groups, which were analyzed by the Mann-Whitney U test ($p < 0.05$)

Sports skills achievement test in physical education courses (Handball sports)

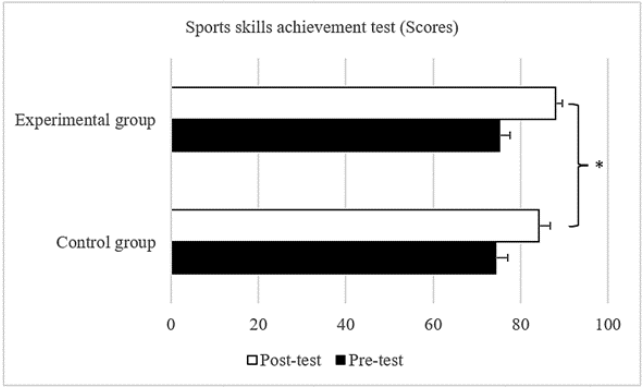

Figure 6. In the post-test: Sports skills achievement test was differences between the control and experimental groups, which were analyzed by the Mann-Whitney U test ($p < 0.05$)

Discussion

The experimental group had Trail making test (TMT) test shown in attention, executive functions, cognitive flexibility, and working memory (Delis et al., 2001; Swanson, 2005; Dwojaczny et al., 2021), which took less time to test than the control group. In addition, the design fluency test (DFT), Which was shown in cognitive performance related to executive function and cognitive flexibility (Delis et al., 2001), including the sports skills achievement test in the experimental group, had more scores than the control group. Because of students who have been trained in high-intensity functional training programs can develop an aerobic system that increases blood to the brain (Querido & Sheel. 2007; Ogoh & Ainslie. 2009; Shenoy et al., 2021; Arfanda et al., 2022) along with the resistance caused by the body weight itself to achieve fast and fast movement which, resistance training can increase the cortisol hormone level (Tsai et al., 2014). In addition, training high-intensity functions increased Brain-derived neurotrophic factors (BDNF) that caused the development in cognitive performance in attention, executive functions, cognitive flexibility, and working memory (Yarrow et al., 2010). Furthermore, Strategy game play in handball consists in remembering movements and deviations, and in associating them to visual landmarks or to experienced events, and to draw a mental map of the environment that can help to improve cognitive flexibility and executive function (Di Tore, 2016; Kiss & Balogh, 2019)

Moreover, high-intensity functional training programs can increase Intrinsic motivation and improve muscle function and the cardiovascular system (Wilke et al., 2019; Menz et al., 2019). Therefore, the experimental group in the part of attention, executive functions, cognitive flexibility, and working memory more than the control group and was related to improve the achievement of sports skills in the experimental group.

Conclusions

The effect of high-intensity functional with strategy sports program training in physical education class for 1 day/week, 1 hour per week, a total of training for 8 weeks. It can develop cognitive performance in terms of attention, executive functions, cognitive flexibility, and working memory, which were part of success in sports skills for high school students.

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Conflict of interest

The author declares that there have no of interest.

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ВПЛИВ ВИСОКОІНТЕНСИВНИХ ФУНКЦІОНАЛЬНИХ ТРЕНУВАНЬ ЗІ СПОРТИВНИМ НАВЧАННЯМ СТРАТЕГІЇ НА КОГНІТИВНУ ДІЯЛЬНІСТЬ ДЛЯ УСПІХІВ УЧНІВ СЕРЕДНЬОЇ ШКОЛИ У ФІЗИЧНОМУ ВИХОВАННІ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 7 с., 2 табл., 6 рис., 29 джерел.

Мета дослідження. Метою цього дослідження є розширення когнітивної діяльності на успішність спортивних навичок у фізичному вихованні в провінції Бурірам (Таїланд).

Матеріали та методи. Вибірку з 80 осіб розподілили на 2 групи по 40 осіб у кожній. Контрольну групу навчали стандартної стратегії навчання гандболу. Експериментальну групу навчали стратегії навчання гандболу з високоінтенсивним функціональним тренуванням. Обидві групи навчалися по 1 годині на тиждень відповідно до звичайного навчального розкладу школи протягом 8 тижнів. Усіх учнів оцінювали за допомогою комп'ютеризованого набору когнітивних тестів і тесту досягнення спортивних навичок до та після експерименту. Аналіз даних дослідження проводили шляхом перевірки відмінностей між групами з використанням параметричних і непараметричних методів статистики.

Результати. Після 8 тижнів експерименту було проведено аналіз різниці між експериментальною групою та контрольною групою в експериментальних даних, який показав, що когнітивна діяльність в рамках уваги, здатності до цілеспрямованої діяльності, когнітивної гнучкості та короткочасної пам'яті займає менше часу в експериментальній групі, ніж у контрольній групі, включаючи аналіз балів за досягнення спортивних навичок у тесті, де експериментальна група мала більше балів, ніж контрольна група, що є статистично значущим результатом за рівня 0,05.

Висновки. Програма високоінтенсивних функціональних тренувань зі спортивним навчанням стратегії на уроках фізичного виховання може розвивати когнітивну діяльність у рамках уваги, здатності до цілеспрямованої діяльності, когнітивної гнучкості та короткочасної пам'яті в учнів середньої школи.

Ключові слова: когнітивна діяльність, досягнення, спортивна навичка, фізичне виховання.

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