

Usage “ADHD Trainer” Game to Improve Cognitive Skill Child With ADHD (The study cases at the child aged 8 years)

Maria Agustini^{1,*}

¹Early Childhood Education Programs, Universitas Negeri Jakarta, East Jakarta, Indonesia.

*Corresponding Email: [Mariaagustini_paud16s3@mahasiswa.unj.ac.id](mailto:Marიაagustini_paud16s3@mahasiswa.unj.ac.id)

ABSTRACT

This study aims to get an overview of the use of ADHD Trainer game to improve cognitive skill in child with ADHD. This study used a qualitative approach. The study was conducted to 8 year old boy diagnosed with Attention Deficit hyperactivity disorder with inattention characteristics: 88.89% and Hyperactivity: 83.33% using test equipment for inattention and Hyperactivity, The result show that ADHD Trainer can improve cognitive skills of children with ADHD in declining rates of attention deficit disorder (inattention): 88.89% to 77.78% and hyperactivity from: 83.33% to 66.67% in ADHD children. The highest gaming scores achieved are 31 in Coordination, 23 on Global, Verbal Fluency, Attention and Scores over World Average on Coordination + 2 of World Average. Gestures and speeches gradually diminish their impulsivity and hyperactivity. Finally, the researcher concludes that there is an improvement of cognitive skills in ADHD children by playing “ADHD Trainer” game

Keywords: ADHD Trainer, Cognitive Skill, ADHD Children

1. INTRODUCTION

In the last decade, disorder *Attention-deficit/ hyperactivity disorder* (ADHD), which causes the disabling becomes difficult to concentrate, impulsivity, and hyperactivity, a problem which is getting a lot of attention and concern among education. Around the world, about 5.3% of children suffer from ADHD, and about two-thirds of patients with symptoms continue into adulthood, according to the research “There are differences in the subcortical brain volume in people with *attention deficit hyperactivity disorder* children and adults: *mega cross-sectional analysis*”(1) It is estimated that ADHD affects approximately 8% to 12% of school-age children (6 -12 years)(2). In Indonesia, the population of primary school children is 16.3% of the total population is 25.85 million. From these data the additional estimated as many as 9000 cases of ADHD cases(3) While research from the Indonesia University and Gadjah Mada University said an average of 7 to 10% of Indonesian children affected by ADHD. It also means that 1 in 10 school-age children experiencing ADHD.

Terminology development of ADHD, Since the 1940s, different interpretations have been introduced from ADHD: *Postencephalitic Behavior Disorder* (PBD), *Brain Damage Syndrome* (BDS), *Minimal Brain Dysfunction* (MBD), *hyperkinetic Reaction of Childhood* (HRC), *Attention Deficit Disorder* (ADD) and finally *Attention-Deficit Hyperactivity Disorder* (ADHD) (4). In *Diagnostik and Statistik Manual of Mental Disorders V* (DSM T-R; *American Psychiatric Association*, 2013) Attention-

deficit/hyperactivity disorder (ADHD) is characterized by an impaired ability to focus (inattention), regulate activity level (hyperactivity), behavioral inhibiting (impulsive) that are not appropriate for at least 6 months at least two domains of life such as in school and at home, and started before the age of 7 years old.

Standard intervention for ADHD include medication, psychosocial and behavioral treatment, and cognitive exercises (5) cognitive training is very useful to overcome cognitive disorders if cognitive training is done individually and in order (6). According to the study conducted in people with ADHD with cognitive impairment, cognitive exercise daily regularly can improve the core symptoms of ADHD with cognitive disorders (7). In addition, recent studies have shown that working memory brain computerized training programs and executive function (the mental skills that are controlled by the area of the frontal lobe that helps to complete a job, for example: manage your time, attention, shift focus, plan and organize, remember the details, avoid saying or doing the wrong thing, do things based on your experience) produce better results than the methods of cognitive training common in children with ADHD (2)

The New cognitive training method based on a video game called TCT method (*Tajima Cognitive Training*) developed by Kazuhiro Tajima-Pozo. TCT method is cognitive therapy every day that require a lot of cognitive training. TCT is a cognitive training methods that are assumed to improve cognitive skills by training cognitive areas, namely: attention, working memory, processing speed, calculation ability, reasoning, and visuomotor coordination(5). The completion rate that is bad of cognitive training therapy is a major hurdle to overcome cognitive

deficits in children with ADHD as children with ADHD often show low motivation to avoid tasks that require more mental effort. TCT method for cognitive training requires children playing the game for 70 minutes per week or 280 per month(8).

1.1. “ADHD TRAINER” GAME CONCEPT

Many researches conclude that the *ADHD Trainer* game is a cognitive training application designed for children with *Attention Deficit / Hyperactivity Disorder (ADHD)*. ADHD Trainer aim is to improve specific areas of cognitive impairment common in children with ADHD are: attention, working memory, processing speed, mental calculation, reasoning, and visuomotor coordination. This exercise is useful for children who show weakness in cognitive or executive function. This exercise trains selective attention, sustained attention, memory, visuomotor coordination, inhibitory control, impulsivity, calculation, verbal sensitivity and reasoning perceptual. This exercise is specifically developed to actually resembles a recreational game to maintain optimal motivation for users (5).

1.1.1. Cheese Finder Trains:

- Developing improved Visuospatial Working Memory (VSWM)
 - functions of working memory that store
 - process visual and spatial information.
- This game also trains reasoning
- Cognitive planning and ability planning

1.1.2. Lost Mouse Trains:

- developing improved Visuospatial Working Memory (VSWM),
- reasoning
- It also trains short-term memory,
- Cognitive planning
 - one of the executive functions, as it encompasses the neurological processes involved in the formulation, evaluation and selection, of a sequence of thoughts and actions to achieve a desire goal.
- ability planning.

1.1.3. Memory Play Trains:

- developing improved memory and attention.
- It trains short-term memory, and selective and sustained attention.
 - selective attention is one of the types of attention that require a person to focus on one activity in the midst of many activities. Sustained attention is used when a person needs to focus on one event for a longer time.

Hidden Toys

- train memory and attention. Specifically,
- trains short-term memory
- selective and sustained attention
- increases concentration in general

Calc-o-matic

- train arithmetic calculation through basic arithmetic operations.
- evaluate the capacity for mental calculation.
- trains reasoning
- semantic memory
- capacity planning

Calc-o-matic II

- train arithmetic calculation,
- reasoning
- semantic memory
- capacity planning, through basic arithmetic operations

Toys

developing improved control of impulsivity,

- motor control,
- capacity planning,
- inhibition of distracters, and
- trains for selective and divided attention.
 - Divided attention is required when a person has to focus on many things at once

Infected garden

Based on the widely used Trail Making Test, this comprehensive game

- trains attention,
- arithmetic calculation,
- reasoning, and
- visuospatial working memory

Face memory

This game will

- train short-term memory and attention,
- improving the capacity to store visuospatial information in a limited time

Squares

This game will

- train visual perceptual reasoning,
- short-term memory and selective attention.
- trains the ability to examine a problem,
- to use visual-motor and visual-spatial skills,
- organize thoughts,
- develop and test solutions.

Sound-matic

This game

- trains children to develop improved visuospatial working memory,
- sustained attention and selective auditory attention.
 - Selective auditory attention or selective hearing is a type of selective attention that involves the auditory system of the nervous system
- Develops improvements in reaction time.

Numbers

This game

- *trains children in developing the ability to understand verbal comprehension and nonverbal reasoning,*
- *as well as short-term memory and selective and sustained attention*

Speed ballons

In this game, the child will

- *train visuospatial working memory,*
- *sustained attention,*
- *selective attention abilities.*
- *train inhibition control,*
- *control of impulsivity and inhibition of distracters*

Color words

Base on the widely used Stroop Test used

- *to assess higher cognitive functions,*
- *this game aims to train visuospatial working memory,*
- *inhibition control,*
- *executive attention*
- *reasoning ability*

2. METHOD

Methods (TCT) is used so-called *ADHD Trainer* game. Subject cognitive research conducted training for at least 10 minutes for 10 days using ADHD trainer game. The subject was given the score after completing each exercise cognitive, which gives immediate feedback on their performance and receive separate scores in the various domains of cognition, including simple calculation, attention, perceptual reasoning, and visuomotor coordination. TCT is a type of *Computer Adaptive Test (CAT)*, because it adapts to the individual's cognitive strengths and weaknesses, based on the value itself from time to time. This is done by storing the scoring record in a database, so that the subject can choose to complete the exercises that show the greatest cognitive disorders area, compared between his own average score and score average for the world.

3. RESULT AND DISCUSSION

Subject of research was one boy with ADHD aged 8 years and 8 months who are diagnosed have a characteristic concentration problems (*inattention*): 88.89% and hyperactivity (*hyperactivity*): 83.33% by using the tool Test for the concentration problems (*inattention*) and *hyperactivity* (ADD / ADHD), ADHD test is made by Kazuhiro Tajima based criteria for children with ADHD of DSM V.

Daily workout goals are reached pre set individual score in a variety of cognitive domains, to complete a successful ten-day training. Exercise “ ADHD Trainer “ described as follows:

3.1. Tests ADHD

Behavioral and academic improvement assessed on ADHD Tests made by Kazuhiro Tajima based on criteria for children with ADHD of DSM V.

Source of:

1) *American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders. 4th edition. Washington DC: American Psychiatric Association; 1994.*

2) *ICSI Guidelines. Diagnosis and management of attention deficit hyperactivity disorder in primary care for school age children and adolescents Available from: URL: <http://www.guideline.gov/>*

3) *El Camino Pediatrics Available from: URL: http://elcaminopediatrics.com/forms_medrecor_ds_childattentionprofile_pf.htm*

4) *Morrison D. Off-task and fidgety. An update on ADHD. The Canadian Journal of CME 2003; February:79-85.*

3.2. Score ADHD Trainer Partisipan

The research took place in the home for 10 minutes per day, for 100 minutes for 10 days using *ADHD Trainer Games* adapted from *Cognitive Training Technique*, The TCT method (*Tajima Cognitive Training*) by Kazuhiro Tajima – Pozo

Note of result cognitive training :

A	: Attention	: 23
M	: Memory	: 19
Ca	: Calculation	: 19
VC	: Visuomotor Coordination	: 31
PR	: Perceptual Reasoning	: 18

Analysis Score:

Highest Score achieved: 31 on Coordination, 23 on Global, Verbal

TABLE 1. COGNITIVE AREA BEING TRATED WITH “ADHD TRAINER”

Day	1	2	3	4	5	6	7	8	9	10
Form	A	Ca	A	Ca	Ca	Ca	A	Ca	A	A
Exercise	M	VC	M	VC	VC	VC	M	VC	M	M
Cognitive		PR		PR	PR	PR		PR		

Note of form cognitive training :

- A** : Attention
- M** : Memory
- Ca** : Calculation
- VC** : Visuomotor Coordination
- PR** : Perceptual Reasoning

TABLE 2. SCORE ARCHIEVED

Exercise per day score	W or d A v e r a g e	1	2	3	4	5	6	7	8	9	10	Total score	Difference with WA
Global	1-48	15	20	29	36	36	36	36	37	38	38	23	10
Coordination	1-35	6	8	22	30	31	31	33	36	36	37	31	2

Memory	1-9	20	23	33	43	44	44	38	38	39	39	19	10
Reasoning	1-4	11	17	20	24	27	28	27	28	29	29	18	5
Verbal Fluency	1-5	19	31	37	40	40	40	39	40	42	42	23	33
Attention	1-7	14	24	34	40	40	40	30	40	42	42	23	5

- Coordination, 23 on Global, Verbal Fluency, Attention reasoning, 19 Memory
- Solve scores **above** World Average (WA): +2 Coordination of WA
- achievement scores **lowest** of the World Average (WA): Verbal Fluency 23 of the score WA 75

3.3. Results of Tests Participants ADHD criteria for ADHD children from DSM V

Improved behavior and academic rated the ADHD test created by Dr. Kazuhiro Tajima based criteria for children with ADHD of DSM V. The test scores are beginning ADHD attention deficit disorder (inattention): 88.89% and hyperactivity (hyperactivity): 83.33% for the parents, and after cognitive training score was attention deficit disorder (inattention): 77.78% and hyperactivity (hyperactivity): 66.67% in children with ADHD for parents. The family reported a significant increase in patients after 10 days TCT cognitive training, which includes important improvements from results of academic and behavior.

3.4. Observations Gesture and Speech depicting Inatensi, impulsivity and hyperactivity

Gesture:

- Successfully: The look on the face of happy, smiling, excited, jumping feet
- Failed: The look on the face of disappointed, depressed, sad, hands covering her face

- challenge: The look on the face of pessimism, boredom, surrender, hand hit the table, feet stomping the floor

Speech:

- Successfully : “horee”
- Field : “yaaah”
- Challenge : “waduh,,,”

• **Analysis:**

• **Inatensi:**

- **Gesture:** The look on the face of disappointed, depressed, sad, pessimistic His face, bored, surrender

- **Speech:** “waduh”

- “yaaah”

▪ **Impulsiveness:**

▪ **Gesture :**

His face disappointed, depressed, sad, Raur advance pessimistic, bores, surrender, hands covering her face

- Speech: “yaaah...”, “waduh’, and “hore”

• Hyperactivity:

• Gesture and Speech:

‘Waduh...: while hand yanking the table, foot stomping floor.

“Yaaah...” while hand covering of thr face, and “Hore!” while foot jumping.

3.5. Interview Results:

3.5.1. CHILD WITH ADHD

Games Trainer For children's fun that is Toy Slot game for fun, it is difficult that mouse lost the game because it is difficult find a way out, to challenge that mouse lost game because it has not managed to find a way out. According to the advantages of this game children of this game from other games is the game is useful make concentration increases and decreases the activity of a bother. If this game drawbacks of this game from other games the child does not know.

According to the child's feelings when you're playing a game is initially annoyed because it failed to continue further engrossed and curious. When finished playing this game feels pretty decent happy because the game is useful for children. When the game can not be solved by either disappointed and sad for failing. When the game can be well pleased as successful and good scores. Children's feelings when it reached a low score : disappointed, middle : curious, height : happy

According to the child, this game is useful because it makes the concentration increases and decreases the activity of a bother. Child stated quite happy to play this game. And the child would advise other people to playthis game because this game is nice and handy.

3.5.2. EXPERT ADHD Dr. KAZUHIRO TAJIMA-POZO

Dr. Kazuhiro Tajima-Pozo, a psychiatrist expert in the diagnosis and treatment of children with ADHD. Trainer ADHD is cognitive training application designed for children with Attention Deficit / Hyperactivity Disorder (ADHD). ADHD Trainer adapted from cognitive training techniques originally developed by him. Trainer ADHD purpose is to improve cognitive impairment in children with ADHD, such as lack of attention, perceptual reasoning, calculation, verbal fluency, and inhibitory control.

According to research conducted on child with ADHD in the regular cognitive training can improve the core symptoms of ADHD. ADHD trainer target specific areas of cognitive impairment common in children with ADHD. These include difficulties with attention, calculation, inhibitory control, verbal fluency, visuomotor coordination and perceptual reasoning. Cognitive training is highly recommended for children who show weakness in cognitive or executive function. This exercise is specifically developed to actually resembles a recreational game to maintain optimal motivation for users. The children were given the score after completing each exercise cognitive, which gives immediate feedback on their performance. Educational research has shown that immediate feedback to improve motivation and interest. This exercise trains selective attention, sustained attention, and attention, memory, visuomotor coordination, inhibitory control, impulsivity, calculation, verbal and reasoning perceptual sensitivity.

Through cognitive training every day, ADHD Trainer Game creates a cognitive therapy program is individualized for each child. This is done by storing the scoring record in a database, so that the child can choose to complete the exercises that show the greatest cognitive disorders area, compared with the average of their own, as well as their colleagues.

3.5.3. PARENTS:

The case study involved a boy who was born in Jakarta (Indonesia) with ADHD aged 8 years and 8 months who are diagnosed have a characteristic concentration problems (inattention): 88.89% and hyperactivity (hyperactivity): 83.33% using assay against attention deficit disorder (inattention) and hyperactivity (hyperactivity) (ADD / ADHD), ADHD tests made by Dr. Kazuhiro Tajima based criteria for ADHD children from DSM V installed in the I-phone. Trainer ADHD child's play that is installed on the I-Phone. Kids playing every night with a duration of 10 minutes for 10 days starting in May-June 2017.

The 38-year-old mother, is diagnosed with Attention Deficit Disorder characteristic of attention deficit disorder (inattention): 83.33% and Impulsiveness (impulsivity): 22:00% by Tests against Concentration of attention and hyperactivity Disorders (ADD / ADHD), which is based on the DSM-5 and another measurement for ADD / ADHD are reviewed by John M. Grohol, Psy.D. His father, aged 41, worked in the field of education and do not present relevant medical history. Participants are their first child. Parents describe generative kids with ADHD. Teachers at the school reported a slump of academic achievement

(mathematics) and liveliness that interfere during the past year. The family reported a significant increase in patients after ten days TCT cognitive training, which includes important improvements from results of academic and behavior.

3.6. DISCUSSION

Supporting the theory (Gonzalo Ruiz Manrique, Kazuhiro Tajima-Pozo et al 2015) regarding the methods of cognitive training new, based on a video game called method TCT (Tajima Cognitive Training) "ADHD Trainer" is a cognitive training that improve **cognitive skill** by train cognitive areas such as attention, memory, calculation, reasoning, and visuomotor coordination (**attention, working memory, processing speed, calculation ability, reasoning, and visuomotor coordination**). Researchers found that a good use of this new technology could be useful for improving cognitive skill of child with ADHD.

Exercise per-day Score	World Average	Total Difference in score of Start - score of End	Difference Score With WA
Global	48	23	10
Coordination	35	31	2
Memory	49	19	10
Reasoning	34	18	5
Verbal Fluency	75	23	33
Attention	47	23	5

Based on the above table is seen that happen significance of the improvement of cognitive skills of children with ADHD with the use of methods of TCT with ADHD Game Trainer. This research proves that the cognitive skill of subject with ADHD increased. In accordance with the new theory of cognitive training methods based on a video game called TCT method (Tajima Cognitive Training) with playing ADHD Trainer game that cognitive skills the subject with ADHD increased. This is in accordance with the journal: Treating ADHD with APP: "ADHD Trainer"(5) and Case Report: "ADHD Trainer" the mobile application that enhances cognitive skills in ADHD Patients(8).

4. CONCLUSION

During the ten-day therapy of cognitive training, participants were allowed to play with a specific game by TCT method, called ADHD Trainer. He must use the game at the same time every day, for at least 10 minutes. Improved behavior and academic rated by parents before and after participants performed ADHD Trainer game. Improved behavior and academic rated the ADHD test created by Dr. Kazuhiro Tajima based criteria for children with ADHD of DSM V. The test scores are beginning ADHD attention deficit disorder (inattention): 88.89% and hyperactivity (hyperactivity): 83.33% for the parents, and after cognitive training score was attention deficit disorder (inattention): 77.78% and hyperactivity (hyperactivity): 66.67% in children with ADHD for parents. The family reported a significant increase in patients after ten days TCT cognitive training that includes important improvements of academic results and behavior. The highest game score achieved was 31 on Coordination (Coordination), 23 on Global (Overall), Verbal Fluency (Language Fluency), Attention (Caution) and break the score on World Average (WA) at +2 Coordination of scores World Average (WA). Gesture and speech gradually reduced implsifitas and hiperaktifitasnya.the researcher concluded that using ADHD Trainers game improves cognitive skills of children with ADHD. Through cognitive training every day, ADHD Trainer application creates a cognitive therapy program is individualized for each child. This study can be recommended for the development of other cognitive training.

REFERENCES

[1]. Wrońska N, Garcia-Zapirain B, Mendez-Zorrilla A. An iPad-based tool for improving the skills of children with attention deficit disorder. *Int J Environ Res Public Health*. 2015;12(6):6261–80.

[2]. Adler LA, Shaw DM, Spencer TJ, Newcorn JH, Sitt DJ, Morrill M, et al. Reliability and validity of the Time-Sensitive ADHD Symptom Scale in adults. *Compr Psychiatry*. 2011;52(6):769–73.

[3]. Sugiarmn M. Teaching Materials for Children with Adhd [Internet]. Jakarta: Gramedia; 2007. 26 p. Available from: http://file.upi.edu/~195405271987031-MOHAMAD_SUGIARMIN/ADHD.pdf

[4]. Waterman AS. The humanistic psychology-positive psychology divide: Contrasts in philosophical foundations. *Am Psychol*. 2013;68(3):124–33.

[5]. Ruiz-Manrique G, Tajima-Pozo K, Montañes-Rada F. Case Report: "ADHD Trainer": the mobile application that enhances cognitive skills in ADHD patients. *J Chem Inf Model*. 2015;53(9):1689–99.

[6]. Martinussen R, Hayden J, Hogg-Johnson S. A meta-analysis of working memory impairments in children

with attention-deficit/hyperactivity disorder. *J Am Acad Child Adolesc Psychiatry*. 2005;44(4):377–84.

[7]. Voelbel G, Ceceli A, Georgieva S. Computerized Neuroplasticity Training Increases Processing Speed of Verbal Information: A Pilot Study of Adults with Traumatic Brain Injury. *J Arch*. 2014;4(1):1–4.

[8]. Ruiz-Manrique G, Tajima-Pozo K. Treating ADHD with APP: “ADHD Traine. Implement Sci [Internet]. 2014;39(1):1–15. Available from: <http://dx.doi.org/10.1016/j.biochi.2015.03.025><http://dx.doi.org/10.1038/nature10402><http://dx.doi.org/10.1038/nature21059><http://journal.stainkudus.ac.id/index.php/equilibrium/article/view/1268/1127><http://dx.doi.org/10.1038/nrmicro2577>