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The effectiveness of sensorimotor games in improving concentration and physical fitness during the covid-19 pandemic

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Abstract

Changes in the learning process during the COVID-19 pandemic have caused a decrease in the concentration of learning in children who are brought to offline learning. This study aims to know the effectiveness of sensorimotor games in improving the concentration and physical fitness of children aged 7 – 12 years. The research method is an experimental design with a randomized pre and post-test control group design with 42 samples divided into 2 groups: a control group and a treatment group. Sensorimotor games are given using the sensory path for 5 repetitions in each session with 12 meetings. The measuring instrument in this study was the digit symbol test to measure concentration levels and 5 measuring tools to measure physical fitness. The data analysis used to test the hypothesis is the paired sample t-test to find out differences in 1 data group and the independent t-test to compare data between groups. Based on the results of the independent t-test between the treatment and control groups after being given a sensorimotor game, the concentration value was p=0.001, coordination p=0.001, balance p=0.000, flexibility p=0.453, agility p=0.228, speed p=0.873. Sensory-motor games improve concentration, coordination, and balance in children aged 7-12 years in Denpasar. Sensorimotor games using sensory pathways can be applied to children who experience a decreased concentration in learning and are an alternative to physical exercise to improve coordination and balance.

Keywords: children, physical fitness, concentration, sensorimotor games, 7-12 years.

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INTRODUCTION

The Covid-19 pandemic is happening all over the world, including in Indonesia. This pandemic has impacted not only the economic sector but also the health and education sectors. This pandemic period has been going on for 2 years. People are encouraged to work or study from home. This

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change in the learning process became less effective, and most students experienced boredom. They wanted to return to face-to-face learning (Puspita Krishna, 2022; Rinawati & Darisman, 2020).

The results of previous research showed that children's interest and motivation for learning decreased during the pandemic, which caused a decrease in the average level of concentration when participating in online learning (Winata, 2021). Based on the results of a UNICEF survey in (Mahajaya, 2021) that the main problem for children when learning online is a need for more concentration of 73% of the elementary school population. Concentration is important because, through concentration, a student can record, remember, and develop the material that has been studied.

Entering the new normal era, several schools have implemented offline learning but must continue implementing health protocols. Depending on their regional zones, the schools still carry out combined learning online and offline. This changing condition impacts the adjustment system when learning is offline, resulting in less optimal learning interactions because children have difficulty concentrating. This also makes students need help understanding the material provided. This decrease in concentration can decrease the student's achievement index (Agustin et al., 2020).

Apart from decreasing concentration, children's physical fitness is also a big problem during the pandemic because physical education learning subjects are only carried out online. This causes a decrease in physical fitness in children, which results in problems with the growth and development of children and reduces the child's ability to carry out daily activities (Ersanto & Wibowo, 2022). Physical fitness is the body's ability to be able to perform specific tasks for a sufficiently long period of time, and the body does not experience fatigue, and there are still reserves of energy to carry out other activities (Rozi et al., 2021; Rusip & Boy, 2020).

The study's results (Ma'arif & Prasetiyo, 2021) stated that the average level of physical fitness in children was in the moderate category during the Covid-19 pandemic. Physical fitness is important to increase

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children's productivity in carrying out daily activities (Arif et al., 2021; World Health Organization, 2018). Physical fitness consists of speed, agility, flexibility, eye-hand coordination, and balance (Ambara, 2017; Sukma, 2021).

Some research shows a decrease in students' concentration and motivation during a pandemic (Reski, 2021; Winata, 2021). Concentration and motivation are very important for students to have while participating in learning activities because the higher the concentration and motivation of student learning, the better the learning results (Winata, 2021).

Interesting methods can be given to overcome decreased concentration and decreased physical fitness of children with sensorimotor games. This method emphasizes using the five senses when children interact with their environment while playing (Putri et al., 2017). The advantages of sensorimotor games with other games are that these games combine sensory and motor coordination, such as eyes, ears, and body muscles. Children will also feel pleasure and not get bored in the training activities provided and train gross and fine motor skills. This game helps students concentrate more when learning in class or when assigned to complete assignments by the teacher (Martika & Subagya, 2014).

This is in line with Baedowi's opinion: "the game method can naturally foster a sense of wanting to learn which previously this kind of feeling was not present in students. It is different when students sit and listen to the teacher's lecture: students will prefer to divert their attention to something else" (Baedowi, 2015). Sensorimotor games can be visual, auditory, tactile, proprioceptive, kinesthetic, or vestibular (Assjari & Sopariah, 2011). In this study, sensorimotor games were used, namely sensory paths arranged in certain obstacles by researchers, which included all components that were expected to increase concentration and physical fitness in children.

This research includes students aged 7 – 12 years with elementary school educational backgrounds. Children aged 7-12 years enter the concrete operational age stage, where the child has entered a concrete and real stage of cognitive development. This becomes very important for the

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success of a learning process, especially the achievement of cognitive competence in children (Marinda, 2020). The implementation of sensorimotor games is expected to increase concentration and physical fitness in elementary school students aged 7-12 years. Sensorimotor play combines the methods of hopscotch games *(engklek)*, puzzles, tandem walking, and throwing 5 balls into the old basket.

METHOD

This research is a randomized controlled study that aims to determine the effectiveness of sensorimotor games in increasing the concentration and physical fitness of children aged 7-12 years. This research has passed the ethical clearance test with no: 1712/UN14.2.2.VII.14/LT/2022. The research was conducted at SDN 4 Ubung in Denpasar, Bali, from June to August 2022.

The research subjects in this study used the inclusion and exclusion criteria as follows. The inclusion criteria included: 1) subjects aged 7-12 years at SDN 4 Ubung, 2) male or female, 3) willing to become research subjects by signing informed consent represented by parents, and 4) students can communicate well and cooperatively. Exclusion criteria included: 1) research subjects had sensory problems, either visual, auditory, or tactile, 2) subjects experienced musculoskeletal injuries one week ago, 3) subjects had congenital diseases such as heart disease, 4) subjects had other exercise programs. The criteria for dropout included: 1) the subject did not take part in the training 3 times, 2) the subject did not take part in the measurement at the end of the study, and 3) the subject withdrew.

Based on the results of the sample calculation, the number of research subjects was set at 17.8 plus 15% to become 21 subjects per group. The total number of subjects in both groups is 42 respondents. The independent variable in the study was sensorimotor play, and the dependent variable was the concentration and physical fitness of children aged 7-12 years.

Before starting the study, the researcher requested permission to sign an informed consent from the student's parents. After that, examination

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and selection were based on inclusion and exclusion criteria, which were then divided into two groups by simple random sampling. In the control group (n = 21), they were not given any training, only learning and practicing regular sports. In the treatment group (n = 21), they were also given sensorimotor games apart from learning and practicing regular sports. Sensorimotor games are given using the sensory path for 5 repetitions in each session with 12 meetings. Sensorimotor play combines the methods of hopscotch games *(engklek)*, puzzles, tandem walking, and throwing 5 balls into the old basket. The game is performed 5 repetitions per session, 3 times a week for 4 weeks, with a total duration of 50 minutes.

Before and after the study (session 1 and session 12), the two groups were equally measured for concentration with the digit symbol test. Several tests were carried out on the child's physical fitness variable, including 1) a 20-meter sprint test to measure speed, 2) a shuttle run to measure agility, 3) a sit and reach test to measure flexibility, 4) a taping plate test to measure hand-eye coordination, and 5) flamingo balance test to measure balance (Ambara, 2017; Sukma, 2021). The data analysis used to test the hypothesis is the paired sample t-test to find out differences in 1 data group and the independent t-test to compare data between groups.

RESULT

The data on the subject's characteristics can be seen in table 1, which shows that in the treatment group, the number of children is primarily male, with a percentage of 57.1%, and in the control group, a percentage of 61.9%.

Table 1. Respondent characteristics

Variable		Intervention Group		Control Group	
		Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Gender	**Male**	12	57.1	13	61.9
	Female	9	42.9	8	38.1
	Total	21	100	21	100
Age	**Frequency (n)**	**Mean**	**SD**	**Mean**	**SD**
	42	8.9	1.81	8.71	1.79

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Table 2. The mean value in the treatment group and control group

Variable	Intervention Group				Control Group			
	Before intervention		After intervention		Before intervention		After intervention	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Concentration[a]	21.67	7.84	33.71	8.84	22.05	6.45	25.52	6.17
Eye-hand coordination[b]	19.84	7.84	14.94	3.32	19.40	3.83	18.71	3.67
Flexibility[c]	-5.60	6.75	-4.48	6.87	-2.88	9.36	-2.57	9.24
Balance[d]	26.54	14.69	43.10	13.08	21.75	14.27	22.87	13.09
Agility[e]	5.46	0.71	5.18	0.64	5.45	0.65	5.44	0.64
Speed[f]	5.83	1.09	5.81	1.09	5.86	0.94	5.85	0.96

[a]digit symbol test, [b]taping plate test, [c]sit and reach test, [d]flamingo balance test, [e]shuttle run, [f]20-meter sprint test

Table 2 describes the results before the intervention was given to the treatment group with a mean concentration value of 21.67, eye-hand coordination of 19.84 seconds, flexibility of -5.60 cm, balance of 26.54 seconds, agility of 5.46 seconds and speed of 5.83 seconds. In the control group, the average concentration value was 22.05, hand-eye coordination was 19.40 seconds, flexibility was -2.88 cm, balance was 21.75 seconds, agility was 5.45 seconds and speed was 5.86 seconds.

The results after the intervention was given to the treatment group with a mean concentration value of 33.71, hand-eye coordination 14.94 seconds, flexibility of -4.48 cm, balance 43.10 seconds, agility of 5.18 seconds, and speed of 5.81 seconds. In the control group with a mean concentration value of 25.52, hand-eye coordination was 18.71 seconds, flexibility -2.57 cm, balance 22.87 seconds, agility 5.44 seconds and speed 5.85 seconds.

Table 3. Paired T-test result

Variabel	Group	Before Intervention		After Intervention		p-value
		Mean	SD	Mean	SD	
Concentration[a]	Intervention	21.67	7.84	33.71	8.84	0.000*
	Control	22.05	6.45	25.52	6.17	0.000*
Eye-hand coordination[b]	Intervention	19.84	7.84	14.94	3.32	0.000*
	Control	19.40	3.83	18.71	3.67	0.053
Flexibility[c]	Intervention	-5.60	6.75	-4.48	6.87	0.052
	Control	-2.88	9.36	-2.57	9.24	0.061
Balance[d]	Intervention	26.54	14.69	43.10	13.08	0.000*
	Control	21.75	14.27	22.87	13.09	0.054
Agility[e]	Intervention	5.46	0.71	5.18	0.64	0.057
	Control	5.45	0.65	5.44	0.64	0.073
Speed[f]	Intervention	5.83	1.09	5.81	1.09	0.071
	Control	5.86	0.94	5.85	0.96	0.089

[a]digit symbol test, [b]taping plate test, [c]sit and reach test, [d]flamingo balance test, [e]shuttle run, [f]20-meter sprint test, *($p<0.05$)

Table 3 shows the results of hypothesis testing using the paired t-test showing the results of sensorimotor play on concentration with p=0.000, eye-hand coordination with a value of p=0.000, and balance with p=0.000.

In the control group, the results obtained significantly changed the concentration value with p=0.000.

Table 4. Independent T-test result

	Grup Data	Mean±SD	p-value
Post-Test (Concentration)	Control Group	25.52±6.17	0.001*
	Intervention Group	33.71±8.84	
Post-Test (Eye-hand coordination)	Control Group	18.71±3.67	0.001*
	Intervention Group	14.94±3.32	
Post-Test (Flexibility)	Control Group	-2.88±9.36	0.453
	Intervention Group	-4.48±6.87	
Post-Test (Balance)	Control Group	22.87±13.09	0.000*
	Intervention Group	43.10±13.08	
Post-Test (Agility)	Control Group	5.44±0.64	0.228
	Intervention Group	5.18±0.64	
Post-Test (Speed)	Control Group	5.85±0.96	0.873
	Intervention Group	5.81±1.09	

*(p<0.05)

Based on table 4, the results of hypothesis testing using the independent t-test stated that there was a difference in effect between the treatment group and the control group on concentration values with p=0.001, hand-eye coordination with p=0.001, and balance values with p=0.000.

DISCUSSION

The Effectiveness of Sensorimotor Play in Improving Concentration

The concentration factor of their learning determines children's learning achievement. The cognitive development of children aged 9-12 is in the concrete operational stage. The ability to focus attention at this age is in 20-30 minutes. At this age, children have curiosity and learn about realistic components, have an interest in practical everyday life, have the view that reports card grades are an accurate measure of the height of achievement, and still need teachers or parents to complete their tasks and desires (Rahmawati, 2014).

Less interesting subjects with high difficulty, an unpleasant learning atmosphere, a feeling of boredom and psychological fatigue in the form of decreased interest and motivation to learn, learning styles, noise in the learning environment, lighting, and health problems become factors that influence children's learning concentration (Setiani, 2014). Other studies explain that a conducive environment and psychological problems are closely related to learning concentration (Setiyorini, 2016).

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Sensorimotor games can be used to deal with a decreased concentration in children aged 7-12 years. This study's results indicate an increase in learning concentration in children who are given sensory motor training using sensory paths. This is in accordance with previous research (Pasaremi, 2014), which showed that sensorimotor training increased learning concentration in group B2 RA Ummatan Wahidah. Other research conducted by (Rohmah et al., 2021) also showed the same results, namely the application of sensorimotor games made changes to increase concentration in students, students became more focused on paying attention to the material conveyed by the teacher, and students were able to do their assignments well. Students who have difficulty concentrating on learning also can answer questions from the teacher, whereas previously, these students often wanted to avoid answering questions.

Sensorimotor games can stimulate the activation of motor nerves, optimize children's sensory functions, and improve their gross and fine motor skills. These gross and fine motor skills are related to activities that can improve children's physical fitness. Sensorimotor games can make children more focused, thereby increasing children's learning concentration. This sensorimotor game also increases children's enthusiasm for learning (Martika & Subagya, 2014).

The Effectiveness of Sensorimotor Games in Improving Physical Fitness

This sensorimotor game uses a sensory path consisting of visual, tactile, proprioceptive, vestibular, and kinesthetic aspects. Based on statistical results, it is stated that sensorimotor games improve children's physical fitness in aspects of balance and eye-hand coordination.

Balance can be improved at school through sports and games. This study uses sensorimotor games, including visual, proprioceptive, vestibular, and kinesthetic aspects, which are factors that can affect balance. The visual system (eyes) is a body monitor and helps a person focus on the main point during static and dynamic movements (Saputri, 2018). Visual information captured by the body can adjust to react to changes in the field

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in the activity environment to provide synergistic muscle work to maintain body balance (Irfan & Susanti, 2015).

Proprioception provides information about the stretching of muscles, the tension in tendons, and the position of joints. Somatosensory information is processed in the spinal cord or the cerebellum (Kisner & Colby, 2012). Projections from the vestibular nuclei contribute to sensory information about head movement and position relative to gravity, gaze stabilization (control of eye movement when the head moves), postural adjustments, and autonomic function and consciousness (Lundy-Ekman, 2018). The three components work together to stimulate the leg muscles' performance in maintaining balance. Playing using sensory paths can improve balance in the child's body.

Hand-eye coordination can improve due to the repetition of throwing 5 balls in sensorimotor games. When throwing the ball, the arms and legs will control the performance of the muscles involved as agonists, antagonists, neutralizers, or stabilizers. At one stage of throwing, the arm will flex at the elbow joint. It causes the performance of the bicep muscles as an agonist and the triceps muscles as an antagonist.

When throwing, keep your arms forward until they do not swing left and right, and do not give results that go off the mark. This activates the performance of the deltoid muscles as a stabilizer and the digitorum muscles as a neutralizer whose performance must be optimized. If it is mapped more simply, when a contraction occurs, the agonist muscle with a flexion movement is changed to an antagonist contraction with an extension movement and vice versa. Thus, the muscles involved in the game experience a stimulus that impacts the Golgi tendons and muscle spindles to improve hand-eye coordination (Syahruddin et al., 2017).

CONCLUSION

Sensory motor games improve concentration, coordination, and balance in children aged 7-12 years in Denpasar. Sensorimotor games using sensory paths can be applied to children with a decreased concentration in learning and are an alternative to physical exercise to

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improve coordination and balance. Some limitations of this study that are used to support the improvement of similar research in the future, namely: (1) Researchers did not control for body mass index variables that could affect the level of physical fitness of children, and (2) Researchers did not add enough kinesthetic aspects in sensorimotor games such as running which was hypothesized can increase agility and speed.

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