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IMPROVING CREATIVITY IN COLLEGE STUDENTS THROUGH PHYSICAL ACTIVITIES

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Abstract

Physical activity not only improves health status and reduces disease, but also has benefits on individual cognitive function. Several studies state that regular physical activity can improve creative thinking, and cognitive factors are needed for invention and innovation. The purpose of this study was to determine the increase in creativity in college students through physical activity. This study uses an experimental approach in the field with an observational action pattern, the research design is two group pretest-posttest design. The population in this study were college students of class 2018, 2019, and 2020 at the department of Sport Coaching Education, State University of Surabaya. In this study using a purposive sampling technique which was divided into two groups, namely AB and AJ, and each group consisted of 30 college students, so that the total sample in this study as many as 60 college students. Pre-test and post-test using the E-Char application to determine the level of creativity. The results showed that post-test results in both groups increased creativity, but the highest increase occurred in the AJ group who had been given physical activity treatment for 14 meetings. The results of the Mann-Whitney difference test showed a value of $p = 0.000 (<0.05)$ which concluded that there was a significant difference in groups AB and AJ. In conclusion, groups that do physical activity for 7 weeks with a frequency of 2 times per week (14 meetings) can increase college students creativity.

Keywords: creativity; physical activity; college student

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INTRODUCTION

Physical activity is known to affect health outcomes throughout a person's life (Bauman, 2004). Optimal physical levels can improve health status and reduce the risk of chronic diseases (eg, cardiovascular disease, cancer, diabetes, and depression) (Warburton et al., 2006). In addition to improving the level of health and preventing disease, physical or physical activity among youth is very important for growth and development (Amornsriwatanakul et al., 2016). The World Health Organization recommends that adults should do at least 150 minutes of moderate-intensity aerobic physical activity or 75 minutes of high-

intensity during the week, while children and adolescents are recommended to do at least 60 minutes of moderate-to-high-intensity physical activity every day (World Health Organization, 2010). In line with the recommendations from WHO, many studies confirm that a person who engages in regular and routine physical activity can improve various cognitive functions, including attention, executive function, memory storage and retrieval, etc (Chen et al., 2021).

Critical thinking, communication, collaboration, and creativity have been classified as the most prominent 21st century competencies identified on the basis of making measurable contributions to educational attainment, relationships, work, and health and well-being outcomes (Scheuer et al., 2015). Creativity is the ability to produce new and original works that are meaningful in their respective contexts (Runco & Jaeger, 2012). Creativity is considered important for social development, because it can lead to an innovation driver and is able to respond to unexpected problems (Scheuer et al., 2015). In general, there are two cognitive processes that underlie creative thinking, namely divergent thinking and convergent thinking (Hennessey & Amabile, 2010). According to (Coren, 1995) Divergent thinking is the way of thinking of someone who is looking for various alternative answers to a problem, usually involving many considerations from several directions or different sources of information (Khery et al., 2013). While Coren (1995) in Khery dkk (2013) convergent thinking is the various ways a person thinks about something which states that there is only one correct answer.

Several studies have shown that exercise in healthy adults can sometimes increase creative thinking, although the size of this effect can vary widely (Blanchette et al., 2005). Optimal physical activity is also needed during childhood to develop thinking process skills, and active play with family and peers can facilitate creative skills (Piya-Amomphan et al., 2020). In addition, someone who does physical activity regularly has a better level of creativity (both convergent and divergent thinking skills) compared to people who have sedentary habits (Colzato et al., 2013).



Therefore, based on the description above, it is important to examine the increase in creativity through physical activity, so that the results of this study can be used as material for scientific studies and the latest references that can be used in future research.

METHOD

This research uses an experimental approach in the field with an observational pattern of action, through the design of the initial test and the two group final test (Two group pretest-posttest design). The experimental design notation is as follows:

Table 1. Notation of Treatment Design

Sample Group	Pre-Test	Treatment	Post-Test
Student Group AB	Y1	Free form of activity (T1)	Y3
Student Group AJ	Y2	Forms of physical activity (T2)	Y4

Table description:

Y1 = Pre-test conditions for creativity

Y2 = Pre-test conditions for creativity

T1 = Free activity group

T2 = Physical activity group

Y3 = Final Test conditions for creativity

Y4 = The conditions of the final test of creativity after being given physical activity treatment

The population of this study used Sports Coaching Education (PKO) students at the State University of Surabaya batch 2018, 2019, and 2020 which were divided by purposive sampling into 2 groups, namely AB and AJ with the criteria for men aged 18-21 years, having a body mass index (BMI) normal, non-athlete, and uninjured. There were 60 trial people who met the criteria, then they were divided into 30 trials per group.

Group AB was given free activity (without physical activity intervention), while group AJ was given physical activity that was programmed for 7 weeks with a frequency of 2 times per week. The physical activity program starts in

September – October 2021. The physical exercise program is described as follows:

Table 2. Physical Activity Exercise Program

No	Week	Day	Type of physical activity	Time	Set	Repetition	Rest
1	I	1	Walk/run	45 minute	1	-	12 -
2		2	Modified water polo	5 minute	6	-	1 minute
3	II	1	Walk/run	45 minute	1	-	2 minute
4		2	Modified volleyball	Game 21	2-3	-	2 minute
5	III	1	Walk/run	45 minute	1	-	2 minute
6		2	Rhythmic gymnastic	45 minute	1	-	2 minute
7	IV	1	Walk/run	45 minute	1	-	2 minute
8		2	Aerobics	45 minute	1	-	2 minute
9	V	1	Modified water polo	5 minute	6	-	1 minute
10		2	Modified volleyball	Game 21	2-3	-	2 minute
11	VI	1	Modified water polo	5 minute	6	-	1 minute
12		2	Rhythmic gymnastic	45 minute	1	-	2 minute
13	VII	1	Modified volleyball	Game 21	2-3	-	2 minute
14		2	Aerobics	45 minute	1	-	-

The physical activity program is carried out in the Surabaya State University campus area using its infrastructure such as a swimming pool, jogging track area, volleyball court and gymnasium. Before treatment, a pre-test was conducted on all groups to determine the ability of initial creativity. After treatment for 14 times, a post test was conducted on all groups to determine the final ability of creativity. The test is carried out by filling in the answers on the *E-Char* application to determine the power of creativity. *E-Char* is an instrument to measure creativity which has aspects of fluency of thinking, flexibility of thinking, originality of ideas, new arrangement (redefinition), and elaboration. Consists of 21 items with 5 alternative answer choices 1 – 5. The test is done by selecting the appropriate behavior from the alternative choices provided. Category Very High score 91 and above, High 74 – 91, Medium 56 – 73, Low 38 – 55, and Very Low 21 – 37.

RESULT AND DISCUSSION

RESULT

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The results of the descriptive analysis of each group

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The results of the mean and standard deviation (SD) after conducting the initial test (pre-test) and final test (post test) are described in table 3.

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Table 3. Descriptive test of each group

No	Group	Mean±SD	
		Pre test	Post test
1	AB	343.63±40.629	385.30±25.882
2	AJ	343.93±31.149	351.80±21.872
3	ΔAJ		41.67±33.673
4	ΔAB		7.87±14.244

AJ = Physical Activity. AB = Free Activity. Δ = difference between post test and pre test results

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The results of the descriptive analysis showed that there was a higher increase in creativity in the group that was given physical activity (AJ) for 14 times. To see a more detailed comparison, it can be seen in Figure 1 which is available below.

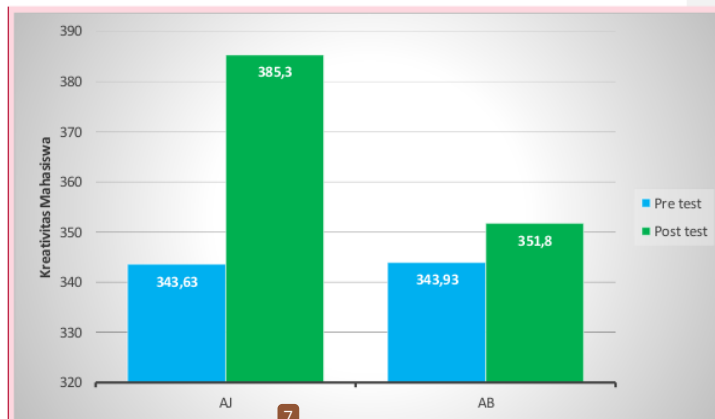


Figure 1. Comparison of the results of the pre-test and post-test of college students' creativity in each group

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In Figure 1, it can be seen that the post test results in all groups experienced an increase in creativity, but the highest increase occurred in the AJ group who had been given physical activity treatment for 14 meetings.

Data Normality Test

Before conducting a different test, it is necessary to know the distribution of the data to be tested. To determine the distribution of the research data, a normality test was performed using the One Kolmogorov Smirnov test. The results can be seen in table 4 below.

Table 4. Normality Test using One Kolmogorov Smirnov

No	Group	P (sig)	Description
1	Pre test AJ	0,200*	Normal distribution
2	Post test AJ	0,004	Not normally distributed
3	Pre test AB	0,200*	Normal distribution
4	Post test AB	0,093*	Normal distribution
5	Δ AJ	0,003	Not normally distributed
6	Δ AB	0,003	Not normally distributed

*significant with $p > 0.05$. AJ = Physical Activity. AB = Free Activity. Δ = difference between post test and pre test results

The results of the normality test with the One Kolmogorov Smirnov test assisted by using the SPSS program showed that the data that were normally distributed were data for the AJ pre-test, AB pre-test and AB post-test.

Different test results using the Mann-Whitney test

To find out whether there is a difference in the value of creativity in the group given physical activity (AJ) and not given physical activity (AB), a different test was carried out. The different test in this study used the Mann Whitney test because the results of the normality test showed that the data were not normally distributed on the difference between the pre-test and post-test results of the two groups (Δ AJ and AB). In more detail, the results of the different tests are presented in table 5 below.

Table 5. Different tests using the Mann-Whitney test

Creativity



6	Mann-Whitney U	106.000
	Wilcoxon W	571.000
	Z	-5.113
	Asymp. Sig. (2-tailed)	0.000

The results of the Mann-Whitney difference test above show a value of $p = 0.000 (<0.05)$. These results can be concluded that there is a significant difference between the AB group and the AJ group, which means that physical activity for 14 times affects the creativity of students.

DISCUSSION

Creativity is the ability to create new things that are original or the ability to solve problems with new methods (Wahyuni et al., 2016). The results of this study showed significant results ($p < 0.05$), which means that giving physical activity treatment for 7 weeks (14 meetings) can increase students' creativity. This is in accordance with the results of Chen et al., (2021) which states that acute physical activity has the potential to increase divergent and convergent thinking. Creative thinking is generally believed to consist of two fundamental cognitive processes: divergent and convergent thinking (Hennessey & Amabile, 2010). Divergent thinking produces several new solutions (Chen et al., 2021). Divergent thinking is the thinking pattern of a person with right hemisphere dominance who thinks creatively to find possible answers with an emphasis on diversity, quantity, and originality of answers (Pahlevi et al., 2018). Ways of thinking with fluency, flexibility, and originality are often used as indicators of divergent thinking (Rauf et al., 2020). While convergent thinking is a person's thinking pattern with left hemisphere dominance who thinks critically related to logic, analysis, language, circuits, and mathematics (Utari, 2019).

The walking activity programmed in this study also has major implications for cognitive and performance enhancement (Oppezzo & Schwartz, 2014). Various types of exercise, including aerobic exercise, jogging/running, and cycling have been shown to improve mood, both in anxious and depressed patients and in

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Title of article

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normal individuals, and after a single session and extended exercise program (Steinberg, 1997). Bidzan-Bluma & Lipowska, (2018) reported that physical activity is associated with brain cognitive function and academic achievement. El-Kholy & Elsayed, (2015) also reported in their study of 135 high school students in Jeddah in the Kingdom of Saudi Arabia that intelligence was positively related to physical activity and health status. A positive relationship between emotional intelligence and physical activity was also shown in 599 university students in Taiwan (G. S. F. Li et al., 2009). Piya-Amornphan et al., (2020) also state that an increase in physical activity is associated with higher intelligence and emotional intelligence in childhood.

Critical thinking, communication, collaboration, and creativity have been classified as the most prominent twentieth century competencies identified based on making measurable contributions to educational attainment, relationships, work, and health and well-being outcomes (Doran & Ryan, 2017). Creativity is important for social development because it leads to the driver of innovation and response to unexpected problems (Doran & Ryan, 2017). Cognitive ability is associated with prefrontal cortex function for creativity. In humans, however, the prefrontal cortex does not fully mature until the early 20s (X. Li, 2016).

CONCLUSION

Physical activity that is given for 7 weeks with a frequency of 2 times per week (14 meetings) can increase the creativity of Unesa students. This increase is the result of the effect of physical activity on brain cognitive function and prefrontal cortex function.

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