

IMPROVING CREATIVE THINKING ABILITIES USING PHYSICAL ACTIVITY IN THE CONTEXT OF UNIVERSITY STUDENTS

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Abstract

The aim of this study was to investigate the impact of physical exercise on the creative thinking qualities of university students. A total of 80 students were randomly selected for the study. Torrance Test of Creative Thinking-Verbal was used to evaluate the creative thinking indicator of the students. During a three-month period, the selected group engaged in regular physical exercise at least three times a week, focusing primarily on table tennis, volleyball, and specially designed team games. For statistical analyses, t-test was used to compare the pre- and post-test results to determine if the observed differences in their scores are statistically significant. The findings confirmed significant differences between the pre and post-test results of TTCT-V scores (fluency: $t=1.023$, $p<0.005$; originality: $t=1.041$, $p<0.005$; flexibility: $t=1.132$, $p<0.005$). The significant difference suggests that exercise effectively enhanced participants' ability to think flexibly and adaptively in creative problem-solving scenarios. Consequently, physical exercise positively influences the creative thinking abilities of university students, as demonstrated by improvements in fluency, originality, and flexibility. It is recommended that educational institutions incorporate more opportunities for physical activity into curricula, fostering an environment conducive to creative thinking and holistic development and actively integrate physical exercise into students' daily routines.

Keywords: creative thinking, active games, physical education classes, university students.

Introduction

In modern society, the importance and significance of physical education are improving. International organizations, such as World Health Organizations (WHO), encourage people to engage in physical activity and incorporate it into their daily routines [1]. The beneficial impact of physical activity can be seen not only in the health or fitness indicators of the person but also in the psychological, well-being, and mental health of the people. The benefits and positive impact of physical exercise are evident from both a physical and mental

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perspective. A recent studies concluded that exercise had a positive effect on both mental health and was effective in avoiding some chronic physical disorders [2]. While, in the context of society, it seems that people are not focusing on being close to physical activity even though this factor is one of the effective and cheapest ways to save their health. UNESCO reports that during the COVID-19 period, declined 41% and it faces more important than ever before [3].

The importance of physical education in the context of higher education is also a discussible issue because of its structure, content and features [4]. The long-time sedentary time increases university students' stress, anxiety, and depression significantly increased despite controlling for economic level, body mass index, underlying disease, and health self management [5]. Drawing upon extensive research, it becomes increasingly evident that the significance and indispensability of physical exercise for university students are profound. Numerous studies have consistently highlighted the multifaceted benefits that regular physical activity brings to students' lives, extending far beyond physical health [6, 7, 8]. On the other hand, factors such as enhanced cognitive function and learning efficiency and bolstering mental well-being and resilience, the holistic impact of exercise on university students is vast and far-reaching [9, 10].

It is crucial to indicate that physical exercise serves as a cornerstone for promoting overall health and vitality among students, contributing to improved cardiovascular health [11] and better weight management [12]. Moreover, regular physical activity has been shown to positively influence students' self-perception [13], confidence levels, and body image, fostering a more positive relationship with oneself [14, 15]. Beyond the physical realm, exercise is pivotal in optimizing cognitive function and academic performance. Research indicates that physical activity stimulates the release of neurotransmitters and growth factors in the brain, promoting neuroplasticity and enhancing cognitive abilities such as memory, attention, and executive function [16]. Engaging in physical activity triggers the release of endorphins and other mood-regulating neurotransmitters, leading to a natural uplift in mood and reduced stress levels. Additionally, exercise provides a constructive outlet for releasing pent-up tension and negative emotions, promoting emotional resilience and psychological well-being [17].

A pivotal aspect of higher education involves fostering students' creative thinking abilities. Creative thinking directly and profoundly impacts students' future careers, learning capabilities, and overall engagement in various

activities [18]. Many researchers have dedicated their efforts to exploring the importance of fostering creative thinking among university students [19, 20]. To date, research examining the correlation between creative thinking and engagement in physical exercise among university students remains limited. While extensive literature exists on the individual benefits of both creative thinking and physical activity, there is a notable gap in understanding how these two factors may interact within higher education. Therefore, this study aims to investigate the impact of physical exercise on the creative thinking qualities of university students.

This study hypothesis that physical exercise has positive effect on the creative thinking qualities of university students.

Materials and Methods

Sample

A total of 80 students enrolled in Bachelor's degree programs at Samarkand State University of Architecture and Construction named after Mirzo Ulugbek, were randomly selected for the study (males, $n=41$, females, $n=39$). The average age of students was 18 ± 3.6 years old.

Instruments

Torrance Test of Creative Thinking-Verbal (TTCT-V; [21]) was used to evaluate the creative thinking indicator of the students. Before initiating the experimental activities, a comprehensive questionnaire specifically designed to assess the creative thinking abilities of the students was administered. This questionnaire included various (indicate number of items) items and tasks aimed at evaluating different aspects of creativity, such as divergent thinking, problem-solving skills, originality, and fluency of ideas. The questionnaire was carefully crafted to provide detailed insights into the creative potential of each participant, serving as a baseline measure for the subsequent analysis of the effects of the experimental interventions.

Procedure

Local Ethical Committee of Samarkand State University of Architecture and Construction named after Mirzo Ulugbek approved this study (№-201/03-IJ, 2023).

Before collecting the data, which happened at a single point, students are informed about the study purpose and ethical procedures were guaranteed,

namely anonymity, responses confidentiality, and voluntary participation. Written consent was obtained from each study participant before their involvement in the research. The selected sample attended to the physical education classes designed by the two researchers within the 3 months (from September to November, 2024). Before starting the study, the creative thinking results of the participants we measured. University lecturers organized physical education classes and exercise for the selected sample.

During a three-month period, the selected group engaged in regular physical exercise at least three times a week, focusing primarily on table tennis, volleyball, and specially designed team games. The duration of each exercise session ranged from 60 to 90 minutes. Physical exercise was organized around students' timetables (Figure 1).

Data Analysis

T-test was used to compare the pre and post-test results (Before vs After) to determine if the observed differences in their scores are statistically significant. A significance level of $p < 0.05$ was used as a threshold level for all statistical analyses, with significant results denoted by asterisks: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Results

(Table 1) compares TTCT-V scores between the pre-test and post-test results of university students. The findings confirmed significant differences between the pre and post-test results of TTCT-V scores (fluency: $t=1.023$, $p \leq 0.005$; originality: $t=1.041$, $p \leq 0.005$; flexibility: $t=1.132$, $p \leq 0.005$). This result indicates that the post-test results exhibited a higher level of cognitive flexibility and an ability to shift between different ideas and approaches. The significant difference suggests that exercise effectively enhanced participants' ability to think flexibly and adaptively in creative problem-solving scenarios.

Discussion

This study aimed to examine the impact of physical exercise on students' creative abilities in the context of the university. The findings aligned that physical activity, such as fitness, table tennis, volleyball, and specially designed team games, have a positive impact on student's academic indicators, in

Table 1. Comparison of TTCT-V scores of pre-test and post-test results (n=80).

TTCT-V Subtests	Pre-Post Tests	Mean	SD	T test	p value
Fluency	Pre-Test	16.33	0.38	1.023	$\leq 0.015^*$
	Post-Test	19.29	0.24		
Originality	Pre-Test	11.47	0.34	1.041	$\leq 0.027^*$
	Post-Test	16.32	0.15		
Flexibility	Pre-Test	14.13	0.28	1.032	$\leq 0.016^*$
	Post-Test	19.31	0.21		

particular, their creative thinking abilities. This study's findings confirm a notable improvement in creative thinking skills among university students who engaged in physical exercise within three months. These finding align with a growing body of literature suggesting that physical activity has a beneficial impact on cognitive functions, including creativity. It is essential to indicate that effective use of physical exercise during the academic year at universities can positively effects students' creative thinking. Our results align with previous studies, which confirmed the positive effect of physical exercise on students' creativity. Previous research suggests physical exercise can impact, harmonious development, motor abilities, intelligence, and creative potential of students [22, 23]. Furthermore, previous studies also confirmed that physical activity have a positive effect on students learning capacities [24, 25]. In this regard, our study results are consistent with and reinforce the conclusions of previous studies. It is noticeable to discuss that significant improvements were found in all three components of creative thinking (fluency, originality, and flexibility). Students who engaged in physical exercise demonstrated a considerable increase in fluency. This enhancement implies that exercise might foster a more divergent thinking process, allowing students to produce more novel and unique ideas. Regarding the originality indicator of creativity, it was observed an improvement on students. Based on this, it can be concluded that physical exercise stimulate the cognitive processes involved in idea generation. While, some studies have also explored the effective impact on verbal fluency [26], our findings can provide new insights relationship between physical activity and creative abilities. Additionally, studies have highlighted that the effects of physical exercise on cognitive and creative performance may vary depending on individual characteristics [27]. They emphasized that personal traits, such as baseline fitness levels, personality, and genetic factors, could influence how effectively physical exercise impacts each person's cognitive outcomes. This suggests that the benefits of exercise might not be uniform across all individuals and that personal differences should be considered when evaluating the impact of physical activity on cognitive functions.

It is also important to highlight that improvement was observed in flexibility, reflecting an enhanced ability to shift between different ideas and perspectives. This is crucial for effective problem-solving, critique and innovation for students within the academic year, and also, in the work process. Further, some investigations confirmed that the improvement in flexibility might be attributed to the cognitive and emotional benefits of exercise, such as reduced stress and enhanced executive function [28, 29]. This study corroborates the findings of earlier research, reinforcing the validity and reliability of those results. Specifically, the data we analyzed align closely with the conclusions drawn in previous studies, thereby providing further evidence that supports their accuracy. By confirming these earlier findings, our research contributes to a more comprehensive understanding of the subject and highlights the continued relevance of the established theories and methodologies used in previous investigations.

Future Research Design and Possibilities

While the current study suggests valuable insights, several areas warrant

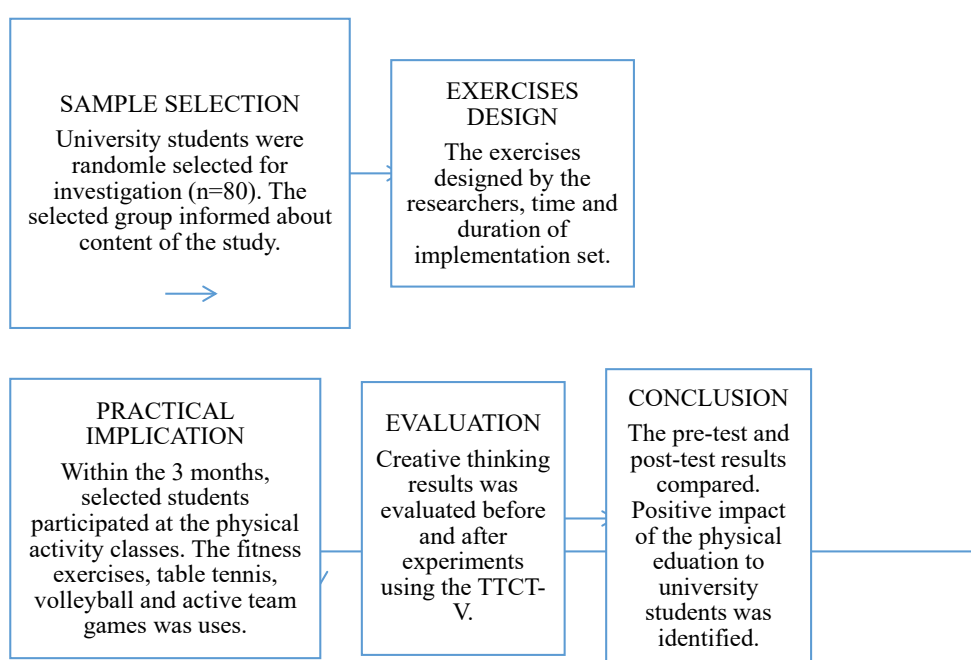


Figure 1. Practical Approach Design.

further exploration to build on these findings: i) One promising direction is the implementation of longitudinal studies to investigate the long-term effects of regular physical exercise on creative thinking. By assessing whether the benefits of exercise are sustained over time, researchers can better understand its impact on academic and professional success; ii) Examining the effects of various types of physical activities on creativity could yield important insights. A comparative analysis of aerobic exercises, strength training, and flexibility workouts may reveal which forms of physical activity enhance creative thinking. Furthermore, incorporating nature-based exercise could further enhance students' creative capacities, highlighting the role of the environment in physical activity; iii) Individual differences also merit exploration. Understanding how factors such as baseline fitness levels, gender, or personality traits influence the relationship between physical exercise and creativity could help in tailoring interventions to maximize effectiveness for diverse student populations; and iv) Finally, conducting mechanistic studies will be crucial for uncovering the specific cognitive and neurobiological mechanisms through which physical exercise enhances creativity. Investigating changes in brain activity, neurotransmitter levels, and mental processes, enables researchers to deepen our understanding of how exercise influences creative thinking.

Limitation of the study

This study's focus on investigating only university students may limit the diversity of perspectives and experiences. In addition, the duration of the physical exercise program may not have been long enough to observe sustained changes in creative thinking. Another limitation is related to the small number of the study sample. Future studies should use a larger sample and include students from universities nationwide.

Conclusion

In conclusion, this study provides strong evidence that physical exercise positively influences the creative thinking abilities of university students, as demonstrated by improvements in fluency, originality, and flexibility. These results underscore the significant role of physical activity in enhancing cognitive function and creativity. Given the findings, it is recommended that educational institutions incorporate more opportunities for physical activity into curricula, fostering an environment conducive to creative thinking and holistic development and actively integrate physical exercise into students' daily routines. Such initiatives could foster better physical health and support the development of essential cognitive skills, thereby enriching students' academic and creative potential. This study holds significant implications for educational practices and student well-being, particularly creative thinking. Findings may encourage educational institutions to incorporate more opportunities for physical activity into curricula, fostering an environment conducive to creative thinking and holistic development. By demonstrating a positive correlation between physical exercise and creative thinking, the research could advocate for policies that prioritize physical activity as a critical component of student life. Ultimately, this study contributes to the broader fields of educational psychology and cognitive science by illuminating the interplay between physical health and cognitive performance, thereby offering practical recommendations for enhancing creativity among university students.

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