International Journal of Evaluation and Research in Education (IJERE)
Vol. 12, No. 1, March 2023, pp. 216~224
ISSN: 2252-8822, DOI: 10.11591/ijere.v12i1.23990

The effectiveness of implementing student physical perfectness techniques for creative thinking development

Tulegen Botagariyev[1], Aibek Gabdullin[2], Aiymgul Akhmetova[1], Zhaxybek Zhunusbekov[2], Nurbol Saitbekov[2]
[1]Department of Mathematics, Aktobe Regional State University named after K. Zhubanov, Aktobe, Kazakhstan
[2]Department of Wrestling, Kazakh Academy of Sports and Tourism, Almaty, Kazakhstan

Article Info

Article history:

Received Feb 23, 2022
Revised Oct 6, 2022
Accepted Nov 4, 2022

Keywords:

Creative thinking
Education
Physical education
Sports
Student

ABSTRACT

Supporting students' physical development and creativity under the influence of modern globalization is one of the key tasks for today's science community. The present study aims to develop an individual program of physical and creative development in first- and second-year female students, taking account of their educational and anthropometric characteristics. Students' level of creative thinking was assessed according to William's methodology, and a physical education program for experimental group respondents was developed to link the two factors. Consequently, the program's implementation demonstrated significant changes in the respondents' creative thinking towards a positive gradation. The number of respondents with low creative thinking scores in the primary follow-up survey increased to an average of 120 students. At the same time, the Chi-square analysis to compare the experimental and control sample in detail indicates that experimental and control sample designs are consistent ($\chi 2 = 122.77$). This study may be used in more in-depth research on the interrelationships between youth's physical and creative development. Besides, it can also serve as a prototype for implementing associated integrated student development programs at the university.

Corresponding Author:

Tulegen Botagariyev
Department of Mathematics, Aktobe Regional State University named after K. Zhubanov
A. Moldagulova Ave., 34, 30000, Aktobe, Kazakhstan
Email: botagariyevtu@rambler.ru

1. INTRODUCTION

The life activity of university graduates in modern society is characterized by high psychophysical stress, which harms health, especially when there are deficiencies in physical development and deviations in the functioning of various body systems. At the present stage of sports medicine development, a system of students' physical education based mainly on the principles of complex achievement evaluation has been established. Modern physical education programs for students do not consider the level of their preparedness and physical condition, which impedes the possibility of differentiating students' physical education [1]. It should be noted that the key aspect of youth psychophysical activity is the impact of this component on an individual's creative and professional tendencies. At the same time, a direct influence of physical activity on the development of diverging thinking is an important argument to advance the physical component in the educational process. The issue of integrating effective physical education is also relevant in the context of inclusive education. For example, a study on the basis of Russian universities shows that students with significant disabilities face a lack of quality physical education and are socially isolated, so the publication notes the creation of an effective sports development program for such students. In addition, it was found that

physical education lessons for students, based on an individualized approach, not only contribute to the preservation of youth health but also increase the level of their socialization [2]. As a consequence, research into methods of improving physical education systems in higher education is quite important at this stage.

Modern processes of globalization require individuals to rapidly make important decisions and adopt non-conventional approaches to the problem. Rapid scientific and technological progress is a major challenge for a society that implies creative thinking in all aspects of socio-economic activity [3]. Accordingly, a relatively important determinant of a person's success in his professional and personal spheres is the format of creative thinking [4]. Furthermore, Tanwattana and Santiboon [5] explored creative thinking as the primary basis for information visualization. According to this theory, any education process should involve forms based on information assimilation projects, which would express the primary need for creativity in every student. As the model of creative thinking is a relatively new trend in education, the efficiency of university research is currently limited. However, the concept of educational reform based on learning, taxonomy, analysis, assessment, and creativity impacts high-level thinking skills.

On the other hand, studies based on Polish universities show that students, in general, demonstrate a low level of a healthy lifestyle. Moreover, a large proportion of students have a level of physical health, which is in the risk zone. However, when investigating the gender aspect, scientists note higher motivation to develop their physical health in male students compared with female students. The publication notes the need to implement a variety of health promotion programs not only to maintain and improve students' healthy lifestyles but also to improve their mental abilities [6]. As a consequence, the implementation of an effective program to improve the physical health of girls, as less motivated subjects of physical education are quite relevant and interesting at this stage of digitalization. At the same time, a significant number of researchers indicate a direct correlation between the physical development of the student and their professional and emotional competencies, including creative thinking, which is a key requirement of employers from any field of activity. The rapid development of cutting-edge technology has contributed to the distraction of research into the benefits of implementing super-efficient physical programs, which are the impetus for successful and multidisciplinary student learning in higher education [7]. As a result, the literature analysis confirms the relevance of the current study on the influence of students' physical development on their divergent abilities in the educational environment.

Given the theoretical background to the study, the main objective involves forming an individual program of physical and creative development of first- and second-year female students, taking into account their academic and anthropometric characteristics. The accomplishment of the set goal includes the following tasks: i) Examining the levels of creative thinking of first- and second-year female students; ii) Developing and implementing a program to increase the physical strength of first- and second-year female students, taking into account their anthropometric characteristics and motor qualities; iii) Comparing the results of the experimental and control group of female students on the effectiveness of the implemented program.

The results achieved will confirm and update the relationship between students' physical and creative development in the early stages of university education. Moreover, they can serve as a prototype for forming a program optimized to meet the criteria under consideration and their implementation into the actual educational process. The novelty of the study lies in identifying the relationship between improving the physical health of female students and their creative thinking through the development of a running and jumping program.

2. LITERATURE REVIEW

Creative intelligence is a cognitive function necessary for life, responsible for generating new ideas and concepts. This format of looking at the world's challenges allows thinking differently to establish new links between existing and hypothetical concepts [8], [9]. It should also be noted that creative thinking is an immediate human companion and is conceived to be used for artistic, informational, technical, and educational purposes. This last aspect probably takes its roots from infancy and acquires its most active progression precisely during the most aggressive phase of knowledge absorption, i.e., schooling. The student's academic activity in school life is a complex of continuous learning of new and new processes and natural phenomena [10]. At the same time, it is essential to apply a creative approach to the theoretical foundations of all academic disciplines, which already allows adolescence to nourish the independence and unified opinion of the future expert. In addition, Yayuk [11] stated that creative thinking is a form of self-expression uniquely. Either way, it makes it possible to broaden the limits of research in the social sciences and humanities and on the exact topics of study. Hence, the fundamental basis for establishing logical links and the primary source of any technical direction for future improvements in information is mathematics.

A study based on the Indonesian education process confirms the close relationship between the physical development activity of students and their creative thinking. Thus, based on a sample of 70 students, the researchers demonstrated the assumption that the vast majority of students obtained satisfactory results

according to the Torrance Tests of Creative Thinking due to successful physical education at school. Besides, the researchers note the exclusivity of the integrated and open model of physical education teaching to expand the influence of this factor on the psychoemotional and academic student's development [12]. Research into the effect of physical activity on school stimulation factors has contributed to the formation of specific recommendations by the university community to identify both impact patterns. Thus, Goryakin *et al.* [13] note that the highest optimum of increasing resistance to fatigue and the perception of the original course content during physical activities can be achieved by the following algorithm. At the beginning of the lesson, the task of increasing the volume of inhaled air into the lungs shall be applied; in the main part – the task of increasing the strength of breathing; in the end – increase the intensity of air passing through the lungs. Two key factors are believed to increase the effectiveness of creative thinking: optimal regulation of physiological tension; performance of simple dance tasks with musical accompaniment [14]. On the other hand, World Health Organization [15] describes creative thinking during information processing and knowledge absorption as a rather resource-intensive and energy-consuming process. Consequently, exercises such as running, swimming, soccer, basketball, and volleyball are recommended, as they significantly reduce stress and fatigue and teach students to work in a team environment [16].

In addition, an experimental study of a group of Spanish students demonstrates a close relationship between moderate and normal physical activity and creativity and emotional intelligence in adolescents [17]. In particular, the publication notes the adaptability of cooperative high-intensity interval training (C-HIIT) implementation, especially in inactive adolescents. The publication documents a dual survey of adolescents on creativity and emotional intelligence (at the beginning and after 12 weeks). Thus, experimental group respondents increased welfare factors and sociability after the C-HIIT program ($p<0.001$), which argues hypotheses nominated by scientists. However, it should be noted that studies are quite unilateral and describe the characteristics of inactive adolescents, while research on the group of healthy and active students aimed at improving physical and creative well-being remains not sufficiently studied.

According to El Jaziz *et al.* [18], a direct relationship between effective physical development and student academic performance has been identified and shaped by cognitive and creative thinking. For example, the relationship between physical strength and academic performance was established by observing resistance to fatigue through tracking cardiac performance when running 20 m and 500 m and variation intelligence. A relatively better correlation was found between the variation in intelligence and the 500 m race results concerning cardiac performance. Developing students' creative thinking is impossible without the proper quality of critical life aspects, such as sleeping, healthy eating, and emotional stability. Among the indicators of physical strength for the long jump, muscle strength, running 50 m, and running to endure fatigue, the opposite is consistent with the values of blood pressure. Only the volume of inhaled air recorded a positive correlation [19]. After switching to a diet and performing aerobic tasks, students showed a decrease in body weight and heart disease [20]. Indicators of a physical condition associated with sleep quality and low physical activity, but not in a state of depression. The incidence of depression was directly related to low physical activity, but not to sleep time. Factors in increasing resistance to depression may be optimizing sleep time and reducing the impact of a sedentary lifestyle on the degree of physical strength [21].

3. RESEARCH METHOD

3.1. Materials

The research was conducted at Aktobe Regional State University named after K. Zhubanov. The study was attended by 200 female students from the faculties of non-sport specialties (100 people in the first year of study, average age 16.5 ± 0.5 years; and 100 people in the second year of study, average age 17.7 ± 0.3 years), which were included in the first and second groups, respectively. The experiment also involved 40 female students of the specialty 'Physical Education and Sport' (the third group, 17.1 ± 0.5 years) from Aktobe Regional State University named after K. Zhubanov, and 20 teachers of physical education (the fourth group, all - women, the average age of 32.2 ± 2.5 years). The study was conducted in three stages. In the first stage, the assessment of the respondents' level of creative thinking was performed (September-October 2019). The second stage included the implementation of the developed program in the experimental group, consisting of 120 female students (50 1st year students, 50 2nd year students, and 20 female students of the profile physical specialty) (average age =16.8 years, SD =9; spectrum 16.7 - 17.3 years). It should be noted that they were selected at random. In other words, respondents in the experimental group constituted the first half of the list of students in each group.

3.2. Research design

The focus of introducing the educational experience was on the preparation, argumentation, and experimental release of methodological ways to improve the techniques of physical perfection of first-year

and second-year female students, considering their physical and anthropometric characteristics. At that, the program was developed based on theoretical recommendations as to the level of influence on the student's creative development. The following missions were set to address this benchmark.

To develop the author's concept, which was to implement the technology of physical improvement of first-year and second-year female students in the universities of the Republic of Kazakhstan, considering the level of their motor skills and anthropometric characteristics. This technology has been based on a differentiated approach and considering the developed assessment scales. The effect of implementing methodological techniques to improve the physical perfectness of first- and second-year female students on the level of their divergent thinking development was substantiated. The preliminary results of the experiment allowed the formulation of the following scientific hypothesis, which was further tested in the primary educational experiment. The author's concept shall consider the overall health condition and motor activity of first- and second-year female students and the correlation between the physical development of female students and their mental abilities, i.e., on the level of their creative thinking. Implementing the physical improvement technique for the first- and second-year female students considering the level of their motor activity and anthropometric characteristics while studying the "Physical Education" subject will significantly increase the effectiveness of the program implementation.

3.3. Study methods

The study implied the analysis of the results of the level of creative thinking before and after the physical development program was introduced into the respondent group education course. For this purpose, one of the components of Williams' set of tests was used, namely the diagnostics of creative (divergent) thinking [7]. Upon applicants' completion of drawings, the results were analyzed using five components of creative thinking: fluency (F), flexibility (FX), originality (O), elaborateness (E), and naming (N). These components are designed to assess a child's ability to think creatively by constructing analogies and diversity with the drawings submitted in the test. In this case, the respondent gets 1 point for each added composition in the first 2 subtests, and the next 3 parts are scored from 0 to 3 points, depending on the degree of brightness of the category manifestation. Consequently, Williams' study of creative thinking can be performed either separately for some subtests or comprehensively by summing up all the scores [7]. A respondent can score a maximum of 131 points during testing. When analyzing each of the study segments, the respondents' results can be evaluated according to the standard deviation level of the obtained index and the intensity of divergent thinking manifestation. In the course of this study, the authors systematized the gross scores obtained for each of the deflection elements and carried out an analysis according to the level of creative tendencies (low, medium, and high) [22].

3.4. Statistical analysis

Statistica v.7.0 (StatSoftInc) was used to process the received data. The methods of mathematical statistics (dispersion analysis) were applied [23]. The creative thinking, motor, and in-game variables were log-transformed and the minimum difference was defined as 0.2 among participants' standard deviations. However, a descriptive analysis was performed using mean and standard deviations for each variable (the mean shown is the back-transformed mean of the log transform) [24].

3.5. Publication ethics

Experiments have been conducted by Helsinki Declaration Ethical Rules [16] since the rules described in this document are fundamental in the context of human rights as an object of study in accordance with the UN provisions. The research was approved by the local ethics committees of Aktobe Regional State University named after K. Zhubanov and Kazakh Academy of Sports and Tourism. The participants have given their written informed consent.

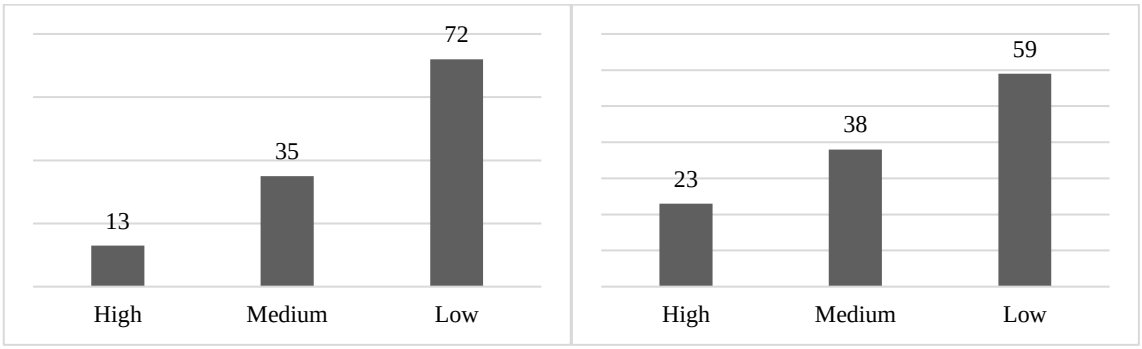
3.6. Limitations of the study

The project was carried out based on a university and covered students of the same gender and only belonged to the first and second years of study. The developed program is unified and subjectively suitable only concerning the sample's particularities but can be adapted for other respondent groups through further research. In addition, the limitation of the study was a limited sample, since the survey was conducted within the same city.

4. RESULTS AND DISCUSSION

In the first stage, the level of creative thinking was evaluated in both groups (experimental and control) according to Williams' indicators [7]. In total, there were 120 participants in each group. All respondents complied with the conditions of implementing an appropriate methodology, which retains the

originality of the primary sample. When analyzing the results, a more qualitative approach was followed for each class. Therefore, the description by the degree of creative thinking (high, medium, and low) was applied. The test resulted in a positive correlation coefficient (Tf) of 0.86, amounting to 4.58 according to the student's t-criterion at v =n – 2 as presented in Figure 1. Figure 1 (a) shows the number of respondents by the level of creative thinking on experimental group and Figure 1 (b) shows on the control group.



(a) (b)

Figure 1. Number of respondents by the level of creative thinking (before the physical development program) on a) experimental group and b) control group

It should be noted that in both experimental and control groups, low levels of creative thinking predominated. Thus, almost half of students in the experimental (60%) and control (49.8%) groups have insufficient skills in divergent approaches to solving academic tasks according to the Williams test. At the same time, a rather small share among first- and second-year female students under study demonstrated a high level of creative thinking, including 11% and 19%, respectively. The initial survey of respondents at the first stage of the study was intended to support the main conclusions of the unsatisfactory level of creative thinking in both groups of female students. It was also an indicator of timeliness and the need for a suitable program to strengthen creative thinking among these respondents.

The program was implemented for two months (8 weeks) of the students' study course (until the end of the 1st semester). It implied an active introduction of sports activities throughout the educational process. Thus, 20 physical education teachers developed a set of compulsory and optional physical activities for the experimental group of female students, which were carried out in their free time. There were three weekly physical activities, two per team and one per person (especially running). The program was implemented based on three academic groups but within the sample respondents. Individual format of the physical training according to the developed program (including running 100 m) showed an unsatisfactory physical development of the female students at the initial stage of the experiment. At the start of the experiment, significant differences in students' fitness levels were revealed. Thus, first-year students had three times the lower level of physical strength in 100 m distance running compared to their second-year peers. Of the 100 individuals, only three had high physical strength indicators ($p \leq 0.02$).

On the other hand, second-year students had four times fewer physical strength points than students in the third group (100-125%, $p \leq 0.01$). Among the third group of students, two demonstrated some level of physical fitness corresponding to the fourth group of teachers, although in the third group, that was 15 times less than in the fourth group ($p \leq 0.0001$). Thus, from the beginning of the experiment, students of non-sport specialties were inferior to students and teachers of physical education. Table 1 shows the results of distance running in four groups, female students and teachers with the highest result (from 100% to 150%).

Table 1. Test results distance running in four groups

Group	Beginning of the experiment	End of the experiment
1	3 (100%)	57 (100%), 3 (125%)
2	9 (100%)	112 (100%), 17 (125%)
3	38 (125%), 2 (150%)	21 (125%), 19 (150%)
4	20 (150%)	20 (150%)

The first week of the program offered a standard format of 40-minute lessons within the limits of running, soccer, and swimming. At the same time, among the electives implemented once every two weeks, students were offered a more active type of activity. That included modern dancing (class every Saturday for 1.5 hours) and yoga (class every Sunday for 1.20 hours). After the first week of implementing the program, a survey was conducted among the female students in the experimental group about their desire to attend an elective. So, the majority (67%) chose modern dancing, while the remaining chose yoga. The team games program (basketball, volleyball, football, and handball) has been designed following university and school program rules and standards.

After implementing a 2-month course of active physical exercises, students' level of creative thinking was re-evaluated. The results of both the experimental and basic groups were analyzed and compared with the preliminary results. According to the Williams methodology, repeated testing showed significant differences in the level of divergent thinking in the experimental group. Thus, there was a shift in gradation of students towards an increase in the level of creativity. The group in which the program was implemented contains approximately one-third of female students with a high level of creative thinking as presented in Figure 2. Figure 2 (a) shows the number of respondents according to the level of creative thinking on experimental group and Figure 2 (b) shows the number of respondents on basic group.

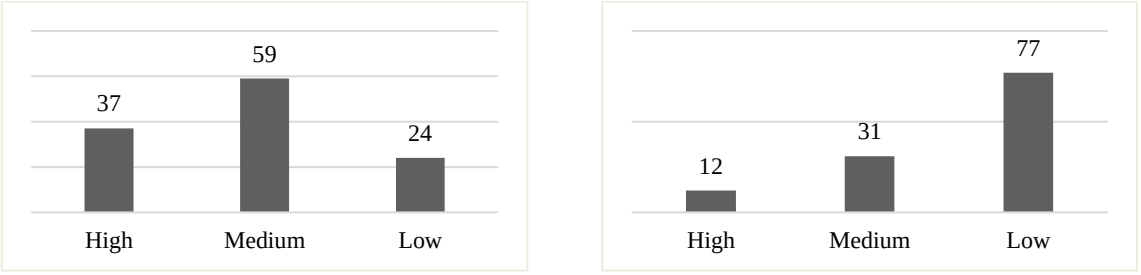


Figure 2. Number of respondents by the level of creative thinking (after the physical development program) on a) experimental group and b) basic group

The majority of students who received a low rating of creative thinking level in the primary survey in the repeated survey enhanced their average level. The total number of students with an average level of development is 59 out of 120 students. On the other hand, controls that have not taken the physical exercise program even aggravated the matching of the number of students with an inadequate level of creative thinking (before implementation – 49%, after – 64%).

Following the implementation of the present program in the educational institution understudy, an analysis of the described approach's effectiveness against the control sample was performed. Thus, according to Williams, testing the divergent level of thinking shows significant structural differences between the control and experimental groups. It should be noted that there were some dangers and expectations regarding the Taylor score when integrating the current physical development program. A Chi-square analysis was used to compare the experimental and control sample in detail. Results indicate that the proposed program under the pretext of developing creative thinking significantly impacts the students. Regarding the explanations with the Chi-square test, the overall consistency indices ($\chi 2=122.77$) indicated a reasonable consistency with the data. Table 2 presents the analysis of students' Chi-squared creative thinking.

Table 2. Analysis of students' Chi-squared creative thinking (N=67)

	Low creative thinking (experimental group)	Low creative thinking (control group)	$\chi 2$
Student creative performance	14%	47%	122.77*

*p=.00

All female students in the three groups had bad habits to a minimum degree, and it is one of the key factors that determined the success of the proposed methodology in all three groups. In the first and second groups, non-sport one, smokers were 2% and 1%, respectively. According to other authors, the majority of experiment participants with normal weight (71.2%) were non-smokers (66.6%), very rarely consumed alcohol (60.5%), and did not spend more than 2 hours per day on a TV screen or the internet [14].

Besides, as found in another research [25], performance may also be related to the level of physical strength directly. The goals of this study were to examine how physical fitness at the entry-level can predict both academic performance and changes in performance one academic year ahead. This study involved 194 adolescents who went to high school, and they conducted tests with a 20 m shuttle run. The authors also evaluated the muscular strength of the lower extremities using a test of long jumping from a place. Similar to the related study, the authors' publication indicates the positive impact of implementing a physical exercise program to train the muscles of the lower limbs on the academic achievement of respondents, expressing the competence to think creatively [26].

This is similar to what Nurjan [27] argues about the relationship between curiosity and creativity regarding the degree of problem resolution in a learning bridgehead. Yes, he believes that issues can be identified and addressed through outdoor activities (volleyball, basketball, soccer, badminton) and adventure activities [28]. Furthermore, his research indicates that students will develop creative thinking skills and practice critical thinking by being involved in such activities. The introduction of aspects of physical development into pedagogy is an important driver for improving the creative development of students, in particular through two interdependent elements: creative learning and physical education of students [29]. The current article indicates a more active implementation of the program in the University's training system (provides for individual exercises), while Nurjan [27] is more inclined to emphasize the motivational aspect of students' extracurricular activities. In a study by Cope *et al.* [30] that looked at how creative thinking skills were acquired in the context of a youth soccer team; it was found that players perceived how they developed. these skills are due to high school culture, not just teaching football. Creative moments can arise from the carefully designed program and system interactions, constantly shaped by socio-cultural, personal, environmental, and task constraints in each athlete's interaction with the environment [31].

Furthermore, Hill *et al.* [32] believed that problem-solving skills play an important part in a student's creativity, while physical education is a stimulus to creative and mental skills. In addition to developing motor skills, physical education enhances collective activities to support positive personality and social development among adolescents. Therefore, in the physical education teacher environment and within the curriculum, the program will positively contribute to the fundamentals of communicative collective attitudes in groups of students, which is a positive aspect of creative thinking. It should be noted that the findings of Hill *et al.* [32] confirm the current article provisions, especially relating to the motivational segment of physical education and creative thinking.

5. CONCLUSION

Activating physical education in the context of increasing the efficiency of educational interest is an essential aspect of the reform of the modern educational bridgehead. The introduction of a set of systematic and rational physical programs affects the formation of students' creative potential, teaches them to approach the task out of the box, develops communication and team skills, and so on. The present study aimed to establish a close correlation between the level of physical education in first- and second-year university students and the degree of their divergent thinking. As a result, the first survey in a sample of 240 university students directly demonstrated the lack of creativity among respondents. Thus, according to the Williams methodology, the high level was assigned to only 15% of the people interviewed. At the same time, most of the 60% and 49.8% in the experimental and core groups of students are characterized by a low level of creative skills. The introduction of a generalized physical development program that included several team and individual games for the experimental group of respondents (n=120) formed a systematic development of female students to reduce the concentration of fatigue, activation of leadership, and creative skills. Implementation of the program revealed significant changes in the results of creative thinking by respondents in favor of positive gradation. In the primary follow-up survey, most students with low creative thinking scores increased to 120 students on average.

Similarly, using Chi-square analysis to compare the experimental and control sample in detail indicated that the experimental and control sample models are consistent ($\chi 2 = 122.77$). This study could have practical application in future research on the interaction between the rationalization of physical education and creative thinking. It can also serve as a prototype to establish similar comprehensive programs for developing creativity in young people by improving their physical perfectness and health condition. Future researchers in this area should pay attention to a narrower group of respondents (for example, women with a low level of physical activity or students with disabilities), which would result in developing a more accurate program for improving their physical health and as a result creative thinking. At the same time, it is also necessary to pay attention to training on an individual and collective basis, while attracting students themselves, which will strengthen their creative potential. One should consider the aspect of motivation in sports as a factor of influence on divergent thinking and emotional intelligence of students.

REFERENCES

[1] M. Ploughman *et al.*, "Synergistic Benefits of Combined Aerobic and Cognitive Training on Fluid Intelligence and the Role of IGF-1 in Chronic Stroke," *Neurorehabilitation and Neural Repair*, vol. 33, no. 3, pp. 199–212, Mar. 2019, doi: 10.1177/1545968319832605.

[2] M. Kudryavtsev *et al.*, "Implementation of the inclusive learning model in the process of physical education of the students with physical disabilities," *Journal of Physical Education and Sport (JPES)*, vol. 19, Supplement issue 3, pp. 971–979, 2019, doi: 10.7752/jpes.2019.s3140.

[3] T. Borodina, A. Sibgatullina, and A. Gizatullina, "Developing creative thinking in future teachers as a topical issue of higher education," *Journal of Social Studies Education Research*, vol. 10, no. 4, pp. 226–245, 2019.

[4] S.-Y. Chen, C.-F. Lai, Y.-H. Lai, and Y.-S. Su, "Effect of project-based learning on development of students' creative thinking," *The International Journal of Electrical Engineering & Education*, vol. 59, no. 3, pp. 232–250, Jul. 2022, doi: 10.1177/0020720919846808.

[5] J. Tanwattana and T. Santiboon, "Setting the goals for early childhood development of their desirable characteristics standards and their creative thinking abilities on physical, emotional, and social developments specifications in the child development centers (CDCs)," *Systematic Reviews in Pharmacy*, vol. 11, no. 11, pp. 891–892, 2020, [Online]. Available: https://www.sysrevpharm.org/abstract/setting-the-goals-for-early-childhood-development-of-their-desirable-characteristics-standards-and-their-creative-thinki-66864.html.

[6] A. M. Rogowska, C. Kuśnierz, and I. Pavlova, "Healthy Behavior of Physical Education University Students," *Health Problems of Civilization*, vol. 14, no. 4, pp. 247–255, 2020, doi: 10.5114/hpc.2020.96392.

[7] F. E. Williams, *A Creativity Assessment Packet*. DOK Publishers, Inc., New York, 1979.

[8] V. Nolan, "Creativity: The antidote to the argument culture," in M. Fryer, Ed., *Creativity and Cultural Diversity*, The Creativity Centre Educational Trust, 2014, pp. 45–51.

[9] L. McGuire *et al.*, "STEM gender stereotypes from early childhood through adolescence at informal science centers," *Journal of Applied Developmental Psychology*, vol. 67, 2020, doi: 10.1016/j.appdev.2020.101109.

[10] C. Montserrat, F. Casas, and J. Llosada-Gistau, "The Importance of School from an International Perspective: What Do Children in General and Children in Vulnerable Situations Say?" in *Education in Out-of-Home Care*, Springer, 2019, pp. 13–27, doi: 10.1007/978-3-030-26372-0_2.

[11] E. Yayuk, Purwanto, A. R. As'Ari, and Subanji, "Primary school students' creative thinking skills in mathematics problem solving," *European Journal of Educational Research*, vol. 9, no. 3, pp. 1281–1295, 2020, doi: 10.12973/eu-jer.9.3.1281.

[12] Dupri, N. Nazirun, and O. Candra, "Creative Thinking Learning of Physical Education: Can Be Enhanced Using Discovery Learning Model?" *Journal Sport Area*, vol. 6, no. 1, pp. 37–47, 2021, doi: 10.25299/sportarea.2021.vol6(1).5690.

[13] Y. Goryakin *et al.*, "Promoting sport and physical activity in Italy: A cost-effectiveness analysis of seven innovative public health policies," *Annali di Igiene Medicina Preventiva e di Comunita*, vol. 31, no. 6, pp. 614–625, 2019, doi: 10.7416/ai.2019.2321.

[14] F. Gallè *et al.*, "The role and working conditions of Movement Science students employed in sport and recreational facilities: An Italian multicenter study," *Work*, vol. 52, no. 2, pp. 385–392, Aug. 2015, doi: 10.3233/WOR-152116.

[15] World Health Organization (WHO), "Global recommendations on physical activity for health," World Health Organization, Geneva, 2010. [Online]. Available: https://www.who.int/publications/i/item/9789241599979.

[16] World Medical Assembly, "Declaration of Helsinki, Recommendations guiding medical doctors in biomedical research involving human subjects," Adopted by the 18th World Medical Assembly, Helsinki, Finland, June 1964, Sep. 2022. [Online]. Available: https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects.

[17] A. Ruiz-Ariza, S. Suárez-Manzano, S. López-Serrano, and E. J. Martínez-López, "The effect of cooperative high-intensity interval training on creativity and emotional intelligence in secondary school: A randomised controlled trial," *European Physical Education Review*, vol. 25, no. 2, pp. 355–373, May 2019, doi: 10.1177/1356336X17739271.

[18] A. El Jaziz, S. Lotfi, and A. O. T. Ahami, "Interrelationship of Physical Exercise, Perceptual Discrimination and Academic Achievement Variables in High School Students," *Annali di Igiene Medicina Preventiva e di Comunita*, vol. 32, no. 5, pp. 528–540, 2020, doi: 10.7416/ai.2020.2373.

[19] Y. Dong *et al.*, "Comprehensive physical fitness and high blood pressure in children and adolescents: A national cross-sectional survey in China," *Journal of Science and Medicine in Sport*, vol. 23, no. 9, pp. 800–806, Sep. 2020, doi: 10.1016/j.jsams.2020.02.016.

[20] M. A. Said, M. Abdelmoneem, M. C. Alibrahim, M. A. Elsebee, and A. A. H. Kotb, "Effects of diet versus diet plus aerobic and resistance exercise on metabolic syndrome in obese young men," *Journal of Exercise Science & Fitness*, vol. 18, no. 3, pp. 101–108, Sep. 2020, doi: 10.1016/j.jesf.2020.03.002.

[21] X. Zhang, X. Gu, T. Zhang, and J. M. Keller, "The mediating roles of sleep quality and sedentary behavior between physical fitness and depression among female college freshmen," *Journal of American College Health*, vol. 70, no. 5, pp. 1528–1535, Jul. 2022, doi: 10.1080/07448481.2020.1809431.

[22] L. A. Dementeva, *Diagnostics of cleverness in children*. Institute for Advanced Qualification and Retraining of Educational Employees of the Kurgan Region, Kurgan, 2009.

[23] F. Pareja-Blanco *et al.*, "Effects of velocity loss during resistance training on athletic performance, strength gains and muscle adaptations," *Scandinavian Journal of Medicine & Science in Sports*, vol. 27, no. 7, pp. 724–735, Jul. 2017, doi: 10.1111/sms.12678.

[24] S. Santos, S. Jiménez, J. Sampaio, and N. Leite, "Effects of the Skills4Genius sports-based training program in creative behavior," *PLOS ONE*, vol. 12, no. 2, p. e0172520, Feb. 2017, doi: 10.1371/journal.pone.0172520.

[25] F. J. Gil-Espinosa, C. Cadenas-Sanchez, and P. Chillón, "Physical fitness predicts the academic achievement over one-school year follow-up period in adolescents," *Journal of Sports Sciences*, vol. 37, no. 4, pp. 452–457, Feb. 2019, doi: 10.1080/02640414.2018.1505184.

[26] L. Ferkins, J. Skinner, and S. Swanson, "Sport Leadership: A New Generation of Thinking," *Journal of Sport Management*, vol. 32, no. 2, pp. 77–81, Mar. 2018, doi: 10.1123/jsm.2018-0054.

[27] S. Nurjan, "The development of creative thinking," (in Indonesian), *AL-ASASIYYA: Journal Of Basic Education*, vol. 3, no. 1, pp. 105–116, Nov. 2018, doi: 10.24269/ajbe.v3i1.1302.

[28] S. D. L. Santos, D. Memmert, J. Sampaio, and N. Leite, "The spawns of creative behavior in team sports: A creativity developmental framework," *Frontiers in Psychology*, vol. 7, Aug. 2016, doi: 10.3389/fpsyg.2016.01282.

[29] L. Devereux, F. Raggiotto, D. Scarpi, and A. Moretti, "Promoting within sport: An exploration of creativity in traditional, extreme and esports contexts," in *Creativity and Marketing: The Fuel for Success*, Emerald Publishing Limited, 2021, pp. 19–32, doi: 10.1108/978-1-80071-330-720211002.
[30] E. Cope, R. Bailey, D. Parnell, and A. Nicholls, "Football, sport and the development of young people's life skills," *Sport in Society*, vol. 20, no. 7, pp. 789–801, Jul. 2017, doi: 10.1080/17430437.2016.1207771.
[31] J. Vaughan, C. J. Mallett, K. Davids, P. Potrac, and M. A. López-Felip, "Developing Creativity to Enhance Human Potential in Sport: A Wicked Transdisciplinary Challenge," *Frontiers in Psychology*, vol. 10, Sep. 2019, doi: 10.3389/fpsyg.2019.02090.
[32] Y. Hill, R. J. R. Den Hartigh, R. R. Meijer, P. De Jonge, and N. W. Van Yperen, "Resilience in sports from a dynamical perspective," *Sport, Exercise, and Performance Psychology*, vol. 7, no. 4, pp. 333–341, Nov. 2018, doi: 10.1037/spy0000118.

BIOGRAPHIES OF AUTHORS

Tulegen Botagariyev is a Doctor of Pedagogical Sciences, Professor at the Department of Mathematics of Aktobe Regional State University named after K. Zhubanov in Aktobe, Kazakhstan. His research interests include physiology, physical development, anthropometric characteristics and motor qualities. He can be contacted at e-mail: botagariyevtu@rambler.ru; Botagariev_1959@mail.ru.

Aibek Gabdullin is a Doctoral Student at the Department of Wrestling of Kazakh Academy of Sports and Tourism in Almaty, Kazakhstan. His research interests include adolescents' career preparation, collaboration of teachers and parents. He can be contacted at e-mail: Aybek_0379@mail.ru.

Aiymgul Akhmetova is a Candidate of Physical and Mathematical Sciences, Associate Professor at the Department of Mathematics of Aktobe Regional State University named after K. Zhubanov in Aktobe, Kazakhstan. Her research interests include electronic textbook, information technologies, and physical education. She can be contacted at e-mail: aaimgul@list.ru.

Zhaxybek Zhunusbekov is a Candidate of Pedagogical Sciences, Head of the Department of Wrestling of Kazakh Academy of Sports and Tourism in Almaty, Kazakhstan. He is an expert in physical development and physical education. He can be contacted at e-mail: zhakz@mail.ru.

Nurbol Saitbekov is a Doctoral Student at the Department of Wrestling of Kazakh Academy of Sports and Tourism in Almaty, Kazakhstan. His research interests include physical development and physical fitness. He can be contacted at e-mail: saytbekov.nurbol@mail.ru.