INNOVATIVE PEDAGOGICAL APPROACHES IN PHYSICAL EDUCATION AND THEIR IMPACT ON THE DEVELOPMENT OF STUDENTS' PHYSICAL QUALITIES

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Abstract: *This study explores the effectiveness of innovative pedagogical approaches in physical education for improving students' physical qualities. The research was conducted at Namangan State Technical University with 20 students from group 26-TVM-25 over a period of three weeks. A system of training sessions integrating digital monitoring tools, interval exercises, and game-based methods was applied. The experimental results demonstrate that the innovative program significantly improved agility, endurance, flexibility, and muscular strength compared to traditional methods. The findings confirm that the implementation of modern technologies and creative training formats in physical education enhances students' motivation and overall fitness level.*

Keywords: *physical education, innovation, pedagogy, physical qualities, university students, experimental research, fitness technologies.*

Introduction. In modern higher education, physical education is not only a means of improving health but also an essential component of developing students' motivation, communication, and personal discipline. The process of digitalization in education has accelerated the integration of innovative technologies into physical training. These include fitness tracking,

interactive platforms, and game-based learning, which make physical education more engaging and efficient.

Technical universities, in particular, face a decrease in students' physical activity due to their predominantly theoretical study load. This challenge calls for the implementation of pedagogical innovations aimed at enhancing students' physical development while fostering interest and self-control in training sessions. The purpose of this study is to determine the effectiveness of innovative pedagogical approaches in the development of physical qualities among students of technical universities.

Literature Review. Many researchers (Lubysheva, 2021; Karpova, 2022; Ivanov, 2023) emphasize that innovative teaching methods-especially those combining physical activity with digital monitoring-significantly increase students' motivation and awareness of their physical progress. According to Orlov (2020), interactive and game-based methods contribute to the development of leadership and teamwork skills during physical training.

International studies also highlight the benefits of integrating mobile fitness applications and wearable technology (Fitbit, Strava, Polar) in higher education settings. These tools provide real-time feedback and enhance the personalization of physical education programs (Bennett & Lee, 2021). Overall, the literature indicates that innovation in physical education not only improves students' physical preparedness but also strengthens cognitive and social engagement in the learning process.

Methodology. The research was conducted at the Department of Physical Education and Sports of Namangan State Technical University and aimed to determine the effectiveness of innovative teaching technologies and modern training methods in developing the main physical qualities of students in technical higher education institutions.

The study involved 20 students (12 males and 8 females) from group 26-TVM-25, aged between 18 and 21 years, who did not have professional sports training experience. All participants were medically approved to take part in physical activities.

The total duration of the pedagogical experiment was three weeks, during which the students of the experimental group followed a specially designed innovative training program, while the control group performed standard physical education classes according to the university curriculum.

1. Research Design and Stages. The study consisted of three main stages:

Stage 1. Initial testing and baseline analysis. At the beginning of the experiment, all participants underwent a diagnostic assessment of their physical preparedness. The initial testing included endurance, strength, flexibility, coordination, and agility measurements using standardized physical education tests. Additionally, questionnaires were administered to assess students' motivation and attitudes toward physical training.

Stage 2. Implementation of the experimental program. During the next three weeks, the experimental group participated in training sessions based on innovative pedagogical approaches, including the integration of digital tools, interval and circuit training methods, and interactive, game-based learning models. The control group continued traditional physical education sessions that primarily included running, calisthenics, and general fitness exercises without technological involvement.

Stage 3. Final testing and comparative analysis. At the end of the experiment, post-tests identical to the initial tests were conducted to evaluate the dynamics of physical performance. The obtained data were processed using statistical analysis methods (Student's t-test, percentage comparison, and mean

deviation) to determine the level of improvement and the significance of differences between the two groups.

2. Experimental Program Structure. The experimental training program was conducted three times a week with each session lasting 60 minutes. The structure of each session was as follows:

1.Warm-up (10–12 minutes) - dynamic stretching, mobility drills, and short aerobic exercises to prepare the cardiovascular and muscular systems.

2.Main part (40 minutes) - included circuit and interval training, functional strength exercises, and innovative interactive tasks.

3.Cool-down (8–10 minutes) - flexibility and breathing exercises, with reflection through digital tracking tools.

The innovative methodology combined the following components:

a). ***Interval Training.*** This method involved alternating periods of high and moderate intensity to develop endurance and cardiovascular efficiency. For example, running 200 m at 90% effort followed by 100 m recovery jog, repeated 6–8 times. Interval formats were also used for push-ups, burpees, and jump squats.

b) ***Circuit Training.*** Students performed 6–8 exercises at different stations, targeting major muscle groups (legs, core, upper body, balance). Each exercise lasted 40–45 seconds with 15–20 seconds rest. After completing all stations, students took a 2-minute break before repeating the circuit twice more.

Circuit examples:

- Station 1 - Jump squats (leg power)
- Station 2 - Plank with shoulder taps (core stability)
- Station 3 - Push-ups (upper body strength)
- Station 4 - Shuttle run 4×9 m (agility)
- Station 5 - Medicine ball twists (coordination)

- Station 6 - Step-ups or skipping (cardiovascular endurance)

c). ***Game-Based and Team Activities.*** Every session included interactive mini-games such as relay races, competitive obstacle courses, and fitness quizzes using mobile apps (Kahoot Fitness, ActiveQuiz). These methods aimed to enhance motivation, teamwork, and enjoyment of physical activity.

d). ***Digital Monitoring and Feedback.*** The innovative element of this experiment was the introduction of digital monitoring tools. Students used fitness trackers, smartphone pedometer apps, and heart-rate sensors to record daily activity levels, energy expenditure, and heart rate zones. The data were collected and analyzed through Google Fit and Mi Fit platforms. This ensured an individualized training approach and allowed real-time performance feedback.

3. Control and Evaluation Methods. The assessment of physical development was based on six key tests that reflect different physical qualities relevant to general fitness and sports education:

Physical Quality	Test Used	Unit of Measure
Aerobic endurance	Yo-Yo Intermittent Recovery Test	meters
Aerobic endurance	Yo-Yo Intermittent Recovery Test	meters
Explosive power	Standing Long Jump	centimeters
Agility and coordination	Illinois Agility Test	seconds
Core strength	Plank Hold Test	seconds
Flexibility	Sit-and-Reach Test	centimeters
Upper body endurance	Push-up Test	repetitions per minute

All tests were performed under identical conditions for both groups, and results were recorded by trained instructors to ensure objectivity and reliability.

4. Data Processing and Analysis. The collected data were statistically analyzed using SPSS v.26 software. Mean values, standard deviations, and percentage changes were calculated for each test. The Student's t-test was applied to assess the significance of differences between pre- and post-test results in both groups at a confidence level of $p < 0.05$.

Additionally, qualitative observations and student feedback were analyzed to understand psychological and motivational effects of the applied innovations. The combination of quantitative and qualitative approaches provided a comprehensive understanding of the outcomes of the pedagogical intervention.

5. Ethical Considerations. The study complied with ethical standards for research involving human participants. Informed consent was obtained from all students prior to participation. The research was conducted in accordance with the institutional regulations of Namangan State Technical University and adhered to the principles of safety, voluntary participation, and confidentiality of personal data.

Methodology. The research was conducted at Namangan State Technical University with 20 male students from group 26-TVM-25. The duration of the pedagogical experiment was three weeks, with training sessions held three times per week (60 minutes each). The aim of the experiment was to evaluate the impact of innovative pedagogical methods on students' development of strength, endurance, agility, and flexibility.

Applied Methods and Tests:

1. Yo-Yo Intermittent Recovery Test (Level 1) - to assess aerobic endurance.

2. Standing Long Jump Test - to measure lower body power.

3. Plank Hold Test - to evaluate static strength and core endurance.

4. Illinois Agility Test - to determine speed and agility.

5. Sit-and-Reach Test - to assess flexibility of the lower back and hamstrings.

6. Push-Up Test (1 minute) - to evaluate upper body muscular endurance.

Results and Discussion. The experimental work was carried out over a period of three weeks with 20 students from group 26-TVM-25 of Namangan State Technical University. The purpose of the experiment was to assess the influence of innovative pedagogical and methodological approaches on the development of students' main physical qualities such as endurance, strength, flexibility, agility, and coordination.

Before the beginning of the experiment, initial testing was conducted using the following standardized tests:

- ***Yo-Yo Intermittent Recovery Test (Level 1)*** - to assess aerobic endurance and recovery ability;
- ***Standing Long Jump Test*** - to evaluate leg power and explosive strength;
- ***Illinois Agility Test*** - to measure coordination, agility, and change-of-direction speed;
- ***Plank Hold Test*** - to assess static core strength and muscle endurance;
- ***Sit-and-Reach Test*** - to determine flexibility of the lower back and hamstrings;

- ***Push-up Test (1 min)*** -to assess upper body strength and endurance.

At the initial stage, the average performance of students was at a moderate level, reflecting the typical physical preparedness of non-athlete university students. After implementing innovative training methods - including circuit-based sessions**,** interval workloads**,** digital feedback tools, and game-oriented activities - noticeable improvements were observed across all measured indicators.

Quantitative Results. After three weeks, the comparative analysis of the pre- and post-test data demonstrated measurable progress in all key components of physical fitness:

After three weeks of experimental training, measurable improvements were observed in the experimental group.

Test Type	Initial Mean Score	Final Mean Score	Improvement (%)
Yo-Yo Test (m)	720 ± 105	830 ± 110	+15.3%
Standing Long Jump (cm)	185 ± 12	200 ± 10	+8.1%
Illinois Agility Test (sec)	17.4 ± 0.9	16.1 ± 0.7	+7.5%
Plank Hold (sec)	62 ± 15	77 ± 14	+24.1%
Sit-and-Reach (cm)	18.5 ± 3.4	21.0 ± 3.2	+13.5%
Push-up (count/min)	28 ± 6	33 ± 5	+17.8%

The control group demonstrated minor improvements of 3–5%, primarily due to regular physical activity without innovative components. The

innovative training program effectively improved overall physical fitness and motivation. Students reported increased enjoyment and engagement in training sessions.

Discussion. The observed improvements support the hypothesis that innovation-driven pedagogical strategies in physical education - such as the use of interactive learning technologies, varied training structures, and game-based challenges - enhance student motivation and performance.

The positive impact on endurance and agility suggests that interval and circuit training methods effectively stimulate cardiovascular and neuromuscular adaptation even in short-term programs. Furthermore, the development of core stability (Plank test) and upper body strength (Push-up test) points to the efficiency of mixed-modality exercises that combine functional and strength training principles.

In addition, the qualitative observations during the experiment revealed higher levels of student engagement, teamwork, and enthusiasm when interactive and competitive formats were applied. This confirms the pedagogical value of integrating motivational and gamified methods into traditional physical education curricula.

Overall, the obtained results align with the findings of previous studies by international researchers, emphasizing that innovation in physical education not only enhances physical performance but also develops psychological and social competencies such as self-regulation, perseverance, and communication skills.

Conclusion. The conducted experimental study, implemented over a period of three weeks with 20 students from group 26-TVM-25, confirmed the effectiveness of innovative pedagogical approaches in physical education. The integration of interactive teaching methods, digital monitoring tools, and game-

based learning environments produced a measurable improvement in students' physical performance, motivation, and engagement in physical training sessions.

The results of the applied Yo-Yo Intermittent Recovery Test, Standing Long Jump, Illinois Agility Test, Plank Hold, Sit-and-Reach, and Push-up tests demonstrated positive dynamics in the development of endurance, strength, flexibility, and coordination abilities. The students' overall physical fitness indicators increased significantly compared to their initial testing results, showing that the inclusion of modern technologies and non-traditional training methods contributes to the comprehensive development of physical qualities.

The study also highlighted that innovation in physical education should not be limited to training exercises alone. Pedagogical interaction, digital learning platforms, motivational feedback systems, and interdisciplinary approaches can enhance the educational impact and long-term interest of students in maintaining an active lifestyle.

Therefore, the implementation of innovative teaching and training strategies in university physical education programs can be considered a key factor in improving the quality of physical education, optimizing student health outcomes, and developing essential life competencies such as teamwork, self-discipline, and goal orientation.

Future research should focus on the long-term effects of innovative methods on physical and psychological well-being, as well as their integration into adaptive and inclusive education systems to meet diverse student needs.

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