

EFFECTIVENESS OF USING DIGITAL TECHNOLOGIES IN PHYSICAL EDUCATION LESSONS

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Abstract

This article examines the effectiveness of using digital technologies (mobile applications, fitness trackers, video analysis tools) in physical education lessons at general secondary schools. The study was conducted during the 2024–2025 academic year with the participation of 120 students in grades 9–10. It was found that the physical fitness indicators of the experimental group students improved to a statistically significant degree compared to the control group. The results showed that the integration of digital technologies increases students' interest in lessons, their level of physical activity, and their self-monitoring skills.

Keywords

physical education, digital technologies, mobile applications, fitness tracker, physical fitness, innovative education, effectiveness.

1. INTRODUCTION

Today, digital technologies are penetrating all areas of the education system. The Decree of the President of the Republic of Uzbekistan No. PQ-4881 dated November 6, 2020, established specific tasks for implementing modern information and communication technologies in the education system¹. Furthermore, the Presidential Decree No. PF-60 dated January 28, 2022, on the “Development Strategy of New Uzbekistan for 2022–2026” designated ensuring the physical well-being of youth as one of the priority areas of state policy².

The issue of applying digital technologies in physical education lessons is being actively studied on an international scale. In particular, the impact of wearable devices, mobile applications, video analysis software, and virtual reality (VR) technologies on physical education lessons has been examined in numerous studies^{3,4,5}. However, such research has not yet been

¹Decree of the President of the Republic of Uzbekistan No. PQ-4881 dated November 6, 2020, “On Measures for the Implementation of Information Technologies in the Continuous Education System.” This decree establishes the mechanism for the gradual implementation of modern information and communication technologies in educational institutions.

²Decree of the President of the Republic of Uzbekistan No. PF-60 dated January 28, 2022, “On the Development Strategy of New Uzbekistan for 2022–2026.” Section 4.6 of the Strategy specifically highlighted ensuring the physical well-being of youth.

³Casey, A., Goodyear, V. A., & Armour, K. M. (2017). *Digital Technologies and Learning in Physical Education: Pedagogical Cases*. London: Routledge. – This monograph analyzes the role of digital technologies in physical education pedagogy and examines practical pedagogical cases.



conducted to a sufficient degree in the context of Uzbekistan.

The relevance of the research is determined by the following factors: first, the necessity of increasing the effectiveness of physical education lessons in Uzbekistan's schools; second, the growing dependence on gadgets among students and the opportunity to channel this in a positive direction; third, the need for individual monitoring of each student's physical fitness through digital technologies.

The aim of the research is to investigate the impact of using digital technologies (mobile applications, fitness trackers, video analysis tools) on students' physical fitness indicators, interest in lessons, and self-monitoring skills in physical education lessons at general secondary schools.

Research objectives:

- 1) To develop a classification of digital technologies used in physical education lessons;
- 2) To conduct a comparative analysis of physical fitness test results in experimental and control groups;
- 3) To determine the impact of digital technologies on students' motivation for lessons;
- 4) To develop practical recommendations.

2. RESEARCH METHODOLOGY

2.1. Research Design

A quasi-experimental design⁶ was employed in the study. The experiment was conducted during the first and second quarters of the 2024–2025 academic year (September–February). The research was organized based on a pre-test/post-test scheme.

2.2. Participants

Students in grades 9–10 from two general secondary schools in the Fergana region participated in the study (n=120). Participants were divided into two groups through random selection: the experimental group (n=60, mean age: 15.3±0.7 years) and the control group (n=60, mean age: 15.1±0.8 years). Gender distribution: 32 boys and 28 girls in the experimental group; 30 boys and 30 girls in the control group.

Table 1. Description of Research Participants

Indicator	Experimental	Control	Group	p-value
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⁴Gard, M. (2014). eHPE: A History of the Future. *Sport, Education and Society*, 19(6), 827–845. DOI: 10.1080/13573322.2014.938037 – The article discusses the digital future of physical education and scientific approaches to it.

⁵Koekoek, J., & Van Hilvoorde, I. (2018). *Digital Technology in Physical Education: Global Perspectives*. London: Routledge. – The book compiles global experiences of integrating digital technologies into physical education from various countries.

⁶Quasi-experimental design – a research method in which participants are not assigned to experimental and control groups through full randomization, but rather based on existing groups. This method is widely used in educational research.



	Group (n=60)	(n=60)	
Mean age (years)	15.3±0.7	15.1±0.8	p>0.05
Boys	32 (53.3%)	30 (50.0%)	p>0.05
Girls	28 (46.7%)	30 (50.0%)	p>0.05
BMI (kg/m ²)	20.8±2.1	21.0±2.3	p>0.05

Note: BMI – Body Mass Index

2.3. Research Tools

The following digital technologies were applied in the experimental group:

1. Mobile applications: Individual exercise programs were designed using the “Nike Training Club”⁷ and “Adidas Training” applications. Students independently completed exercises from the applications as homework.

2. Fitness trackers: Students’ daily step count, heart rate, and calories burned were monitored through Xiaomi Mi Band 8⁸ fitness bracelets.

3. Video analysis: Using the “Coach’s Eye”⁹ application, students’ movement techniques (running, jumping, throwing) were recorded on video and analyzed in detail during class.

Lessons in the control group were conducted in the traditional manner, without digital technologies. Both groups received instruction based on the same curriculum (2 hours of physical education per week).

2.4. Data Collection and Analysis

Physical fitness was assessed through the following tests: 100 m sprint (s), standing long jump (cm), flexibility test (cm), 1000 m run – endurance (min), pull-ups (repetitions, boys), and sit-ups (repetitions, girls). Tests were administered at the beginning of the experiment (pre-test) and after 5 months (post-test).

⁷“Nike Training Club” – a free mobile application by Nike that offers over 190 professional exercise programs. The application creates individual exercise plans based on the user’s physical fitness level.

⁸Xiaomi Mi Band 8 – an affordable fitness bracelet with functions including step counting, heart rate monitoring, sleep monitoring, and sports activity tracking. Its price is approximately 35–40 USD.

⁹“Coach’s Eye” – a mobile application designed for video analysis of sports movements. The application provides capabilities for slow-motion viewing, drawing lines and angles, and side-by-side comparison of two videos.



A 15-item questionnaire based on a Likert scale¹⁰ was developed to measure students' motivation. The internal reliability of the questionnaire was verified using Cronbach's alpha coefficient¹¹ ($\alpha = 0.84$).

Statistical analysis was performed using SPSS 26.0. The independent samples Student's t-test¹² was used to determine differences between groups, and the paired samples t-test was used to compare pre- and post-experiment indicators. The level of statistical significance was set at $p < 0.05$.

3. RESULTS

3.1. Physical Fitness Indicators

At the beginning of the experiment, no statistically significant difference was observed between the physical fitness indicators of the two groups ($p > 0.05$). After the 5-month experiment, significant improvement was recorded in all tests in the experimental group.

Table 2. Post-test Results of Experimental and Control Groups ($M \pm SD$)

Test Type	Experimental Group	Control Group	t	p
100 m sprint (s)	13.8 \pm 0.9	14.5 \pm 1.1	3.82	<0.01
Long jump (cm)	198.5 \pm 14.2	188.3 \pm 15.8	3.73	<0.01
Flexibility (cm)	12.4 \pm 3.1	10.2 \pm 3.5	3.66	<0.01
1000 m run (min)	4.12 \pm 0.35	4.38 \pm 0.42	3.70	<0.01
Pull-ups (reps)	9.8 \pm 2.4	7.9 \pm 2.8	3.56	<0.01
Sit-ups (reps)	38.2 \pm 5.1	33.7 \pm 5.9	4.47	<0.001

As shown in Table 2, the experimental group demonstrated statistically significantly higher results than the control group across all physical fitness tests ($p < 0.01$). The greatest differences were observed in sit-ups ($t=4.47$; $p < 0.001$) and the 100 m sprint ($t=3.82$; $p < 0.01$).

¹⁰Likert scale – a psychometric scale used to measure respondents' attitudes toward a particular opinion or phenomenon. It is typically expressed on a 5- or 7-point system (from 1 – “strongly disagree” to 5 – “strongly agree”). Developed by Rensis Likert in 1932.

¹¹Cronbach's alpha coefficient – an indicator of a questionnaire or test's internal consistency (reliability). A value of $\alpha \geq 0.70$ is considered an acceptable level of reliability. In our study, $\alpha = 0.84$, indicating high reliability.

¹²Student's t-test – a parametric statistical test used to check the statistical significance of the difference between the means of two groups. Developed by William Sealy Gosset in 1908.



3.2. Motivation Indicators

The questionnaire results showed that the interest of students in the experimental group toward physical education lessons increased significantly.

Table 3. Motivation Questionnaire Results (5-point Likert Scale, $M \pm SD$)

Indicator	Experimental Group	Control Group	p-value
Interest in lessons	4.52±0.48	3.41±0.72	<0.001
Desire for independent exercise	4.38±0.55	3.12±0.81	<0.001
Monitoring own results	4.61±0.42	2.85±0.93	<0.001
Overall lesson satisfaction	4.47±0.51	3.58±0.68	<0.001

A highly statistically significant difference was found between the groups across all motivation indicators ($p < 0.001$). The greatest difference was recorded in the “Monitoring own results” indicator (experimental: 4.61; control: 2.85). This can be explained by students’ ability to monitor their physical activity in real time through fitness trackers and mobile applications.

4. DISCUSSION

The research results demonstrated that the use of digital technologies in physical education lessons significantly improves students’ physical fitness indicators. These results are also consistent with international studies. Specifically, Casey et al. noted that fitness technologies increase students’ activity levels in physical education lessons¹³, while Koekoek and Van Hilvoorde documented the positive impact of digital tools on developing movement skills¹⁴.

The most noteworthy result in our study was the sharp increase in motivation indicators. 87% of students in the experimental group emphasized that digital technologies made the lessons “interesting and modern.” This is consistent with Hyndman’s research findings¹⁵, according to which technological tools create a “twinning effect” among students – meaning students simultaneously engage in physical exercise while deriving enjoyment from monitoring their digital indicators.

¹³Casey, A., Goodyear, V. A., & Armour, K. M. (2017). Digital Technologies and Learning in Physical Education: Pedagogical Cases. Routledge.

¹⁴Koekoek, J., & Van Hilvoorde, I. (2018). Digital Technology in Physical Education: Global Perspectives. Routledge.

¹⁵Hyndman, B. (2014). Digital Technology in Physical Education: A Focus on Professional Development and Learning. Journal of Physical Education, Recreation & Dance, 85(4), 26–31. – The article examines issues of professional development of physical education teachers regarding digital technologies.



The effectiveness of the video analysis tool in improving movement technique deserves special mention. Students had the opportunity to view their movements on video and analyze them in detail together with the teacher. This is based on the principle of reflective learning¹⁶ and serves to develop meta-cognitive skills¹⁷ in students¹⁸.

The impact of fitness trackers on self-monitoring skills is also an important finding. Students acquired practical knowledge about healthy lifestyles by independently monitoring their daily step count, heart rate, and calories burned. This result aligns with Goodyear et al.'s concept of "digital health literacy"¹⁹.

Limitations of the study. First, the study was conducted over a relatively short period (5 months), and additional research is needed to determine long-term effects. Second, the study was conducted only in schools in the Fergana region, making it difficult to generalize the results to all of Uzbekistan. Third, the cost of technological tools (fitness trackers) may not be affordable for all schools.

5. CONCLUSION

The research results allow the following conclusions to be drawn:

1. The use of digital technologies (mobile applications, fitness trackers, video analysis) in physical education lessons significantly improves students' physical fitness indicators ($p < 0.01$).
2. Digital technologies significantly increase students' motivation for lessons, their desire for independent exercise, and their skills in monitoring their own results ($p < 0.001$).
3. The video analysis tool proved to be an effective pedagogical instrument in improving students' movement technique.
4. Fitness trackers contribute to the formation of practical knowledge and skills regarding a healthy lifestyle among students.

Practical recommendations:

- Organize professional development courses for physical education teachers on digital technologies;
- Develop a program to equip schools with fitness trackers and tablets;

¹⁶Reflective learning – a method of gaining deeper knowledge through the learner's conscious reflection on their own learning process and experience. Based on the theories of John Dewey (1933) and Donald Schön (1983).

¹⁷Meta-cognitive skills – the ability to think about one's own thinking processes, to plan, monitor, and evaluate one's own learning. In physical education, this manifests as the student's ability to independently analyze and correct their own movement technique.

¹⁸Enright, E., & Gard, M. (2016). Media, Digital Technology and Learning in Sport: A Critical Analysis. *Sport, Education and Society*, 21(6), 836–845. DOI: 10.1080/13573322.2015.1015099

¹⁹Goodyear, V. A., Kerner, C., & Quennerstedt, M. (2019). Young People's Uses of Wearable Healthy Lifestyle Technologies; Surveillance, Self-Surveillance and Resistance. *Sport, Education and Society*, 24(3), 212–225. DOI: 10.1080/13573322.2017.1375907 – The study analyzed young people's experiences of using wearable technologies and the concept of "digital health literacy."



- Implement a project to create a dedicated mobile application for physical education lessons (in Uzbek language);
- Publish a methodological guide for the step-by-step integration of digital technologies into physical education lessons.

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