THEORY and PRACTICE
of Physical Culture and Sports

https://tppcs.com.ua/
Vol. 4, No. 2, 2025

Received: 02.07.2025.Revised: 20.11.2025. Accepted: 24.12.2025. Published: 09.01.2026.

ISSN 2786-6432
e-ISSN 2786-6424

UDC 796:378
DOI: 10.69587/tppcs/2.2025.22

Analysis of the effectiveness of distance learning in physical education in higher education institutions

Nataliia Panhelova*

Doctor of Physical Education and Sport, Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskoho Str., Pereiaslav, Ukraine
https://orcid.org/0000-0001-9133-0889

Andrii Pivovar

PhD in Physical Education and Sport, Associate Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskoho Str., Pereiaslav, Ukraine
https://orcid.org/0000-0002-6157-1566

Tetiana Kravchenko

PhD in Pedagogy, Associate Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskoho Str., Pereiaslav, Ukraine
https://orcid.org/0000-0002-6041-3101

Abstract. This study aimed to provide an empirical verification of the effectiveness of a comprehensive methodology for distance learning in the discipline of Physical Education within the educational process of students in the humanities (Faculty of Arts, Management, Pedagogy, and Psychology). The experimental phase of the research was conducted from February to May 2025 at Hryhorii Skovoroda University in Pereiaslav. To achieve the stated aim, a pedagogical experiment was carried out on a student sample ($N = 120$), which included assessments of physical fitness, questionnaire surveys, and correlation analysis using Student's t test to determine the statistical significance of differences between the experimental and control groups. The findings demonstrated that the comprehensive distance learning methodology, incorporating synchronous classes and systematic monitoring, ensured a statistically significant increase in objective indicators of physical fitness ($p < 0.01$ or $p < 0.001$), whereas such improvements were not observed within the traditional model of distance learning. Students in the experimental group exhibited substantial progress across all six evaluated indicators: overall satisfaction increased from 27% to 63%, perceived effectiveness from 23% to 75%, intrinsic motivation from 25% to 70%, independent organisation of learning from 33% to 80%, adequacy of physical workload from 45% to 85%, and the integral index of overall assessment rose from 17% to 55%. All observed shifts were statistically significant ($p < 0.001$), thereby confirming the sustained positive impact of the enhanced distance learning methodology. The obtained data indicate the statistically significant effectiveness of the tested distance learning methodology, which ensures positive dynamics in the development of students' physical qualities. A high degree of correlation was identified between the level of daily physical activity and indicators of endurance. In addition, quantitative analysis confirmed a substantial increase in the level of intrinsic motivation and satisfaction with learning in the experimental group. These findings are of practical significance for optimising the process of distance physical education in higher education institutions

Keywords: digital transformation; physical activity; health; demotivation; educational process; physical qualities

Introduction

The relevance of investigating the effectiveness of distance learning in physical education in higher education institutions is determined by a set of global and local factors that have significantly transformed the educational environment. The transition to a remote learning format, caused by the COVID-19 pandemic and the war, has imposed new requirements on the higher education system regarding the adaptation of traditional academic disciplines, including physical education, to the digital space. Physical education in higher education institutions performs an

Suggested Citation: Panhelova, N., Pivovar, A., & Kravchenko, T. (2025). Analysis of the effectiveness of distance learning in physical education in higher education institutions. *Theory and Practice of Physical Culture and Sports*, 4(2), 22-31. doi: 10.69587/tppcs/2.2025.22.

*Corresponding author

Copyright © The Author(s). This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/)

important function in developing health-preserving competence and in maintaining students' physical and psychological well-being, which necessitates an analysis of the possibilities for ensuring its effectiveness under distance learning conditions. An insufficient level of physical activity among students is associated with a subsequent deterioration in cognitive functions and mental health, as confirmed, inter alia, by the research of E.A. Haapala *et al.* (2025), who considered childhood physical fitness as an indicator of future cognitive and psychological development. Thus, a need emerged not only to transfer the educational process to the online environment, but also to identify and analyse methodologies capable of ensuring the achievement of the discipline's objectives under conditions of physical separation between participants in the educational process. The transition to distance learning was predominantly compulsory rather than planned, which led to the application of diverse approaches requiring systematic analysis. Of particular relevance is the identification of didactic models, technological solutions, and organisational forms that are able to ensure high-quality learning outcomes, sustain learning motivation, and promote the development of students' physical qualities.

In academic discourse, considerable attention has been devoted to the general aspects of the impact of distance learning on higher education. D. Turnbull *et al.* (2021) examined universities' responses to the transition to e-learning during the COVID-19 pandemic and found that the success of institutional adaptation depended on technological preparedness and organisational flexibility. By contrast, B.N. Alarifi & S. Song (2024) compared online and face-to-face learning in higher education. Their study demonstrated that online learning provides flexibility and accessibility, but reduces social interaction and student engagement. M. Alenezi (2023) analysed digital learning and the formation of digital institutionalisation in higher education institutions, emphasising that the effective implementation of technologies enhances the quality of education and fosters the development of students' digital competences.

Meanwhile, I.G. Bondarenko *et al.* (2020) assessed the organisation of distance training for future specialists in physical education. The authors noted that the effectiveness of classes depends on the use of interactive methods and the monitoring of physical activity, thereby demonstrating the practical significance of the distance learning format in discipline-specific contexts. O.M. Nesterenko *et al.* (2024) analysed innovative approaches to teaching physical education in higher education institutions. Their study showed that the integration of digital simulators and online platforms enhances learning outcomes and contributes to the development of students' physical qualities. In the research of O. Mozolev (2022), the specific features of organising students' physical education under distance and blended learning conditions were described, with an emphasis on the necessity of adapting curricula to new circumstances.

L. Moustakas & D. Robrade (2022) examined e-learning in the field of university sport and physical education during the COVID-19 pandemic. They emphasised that digital methods make it possible to maintain motivation and regularity of training even in a remote format, which indicates the promising future and relevance of using electronic technologies in sports education. By contrast, J.K. Kohli *et al.* (2025) developed a scale to assess teachers' readiness for distance learning. The results demonstrated that a high level of e-readiness contributes to the effectiveness of the pedagogical process and facilitates the adoption of new technologies. B. Bashir & A.L. Lapshun (2025) explored the prospects of e-learning in higher education in the 2020s and beyond, emphasising that the integration of innovative digital platforms and technical solutions is crucial for improving educational quality and adapting to changes in teaching practices.

Despite the growing scholarly attention to this issue, several aspects remain insufficiently addressed in contemporary research. A substantial proportion of studies have focused on the general organisational parameters of the transition to distance learning or have relied on subjective evaluations by participants in the educational process. The issues of objectively measuring the effectiveness of distance learning in physical education on the basis of physical fitness indicators, the development of motor skills, and the comparison of these results with data obtained under traditional face-to-face instruction remain inadequately explored. Studies devoted to the training of specialists in physical education have also not fully considered the specific characteristics of teaching students in the humanities, for whom physical education functions as a general education discipline. Insufficiently investigated are the questions of the long-term impact of distance learning on students' levels of physical activity after returning to in-person instruction, as well as the need to take into account the conditions of local crisis events. In this context, there is a clear need for research aimed at determining the impact of distance learning in physical education on objective indicators of students' physical fitness in higher education institutions and at identifying methodological approaches capable of ensuring positive dynamics in these indicators.

This study aimed to conduct an experimental verification of the effectiveness of a comprehensive, author-developed methodology for distance learning in physical education for students of the Faculty of Arts, Management, Pedagogy, and Psychology at Hryhorii Skovoroda University in Pereiaslav. To achieve this aim, the following research objectives were defined: to assess the impact of the implemented methodology on students' physical fitness indicators; to examine the possibilities of using digital tools for monitoring physical activity through the application of fitness trackers; and to analyse students' levels of satisfaction, learning motivation, and engagement in the process of distance physical education classes.

Materials and Methods

The empirical study was conducted from February to May 2025 at Hryhorii Skovoroda University in Pereiaslav. The total sample comprised $N = 120$ first-year students with a mean age of 18.1 ± 0.4 years; the sample included 60 males and 60 females. The research was based on a pedagogical experiment. The inclusion criteria were enrolment in the first year of study, provision of informed consent to participate, an initial level of physical fitness, regular attendance of academic classes, and active participation in physical culture and health-related activities. The initial level of physical fitness was determined using standardised tests that assessed endurance, strength, speed-strength abilities,

and flexibility. The exclusion criteria included the presence of medical contraindications to physical activity, participation in professional sports clubs, and absence from more than 20% of distance learning classes. Participants were divided into a control group (CG, 60 students: 30 males and 30 females, mean age 18.2 ± 0.3 years) and an experimental group (EG, 60 students: 30 males and 30 females, mean age 18.0 ± 0.4 years), with comparable baseline levels of physical fitness. Full confidentiality was guaranteed to all participants. The study was conducted in accordance with international ethical standards, including the Code of Ethics of the American Sociological Association (1997) and the European Commission (2021) on ethics and data protection, and was approved by the university's ethics committee. To achieve the research objectives, a set of empirical methods was applied, including measurement, observation, testing, and comparison.

A formative experiment was conducted in which the CG was taught according to the traditional model of distance learning, which involved two classes per week, each lasting 60 minutes, delivered in the format of lectures and demonstrations. The EG followed a developed comprehensive methodology aimed at increasing students' physical activity. The methodology for the EG integrated three synchronous sessions per week via Google Meet (n.d.) (45-60 minutes each) and two asynchronous sessions on the Moodle (n.d.) platform, combined with structured physical exercises. Each session included the following stages: a warm-up (aerobic exercises, 10-15 minutes), a main part (strength and aerobic exercises, 25-35 minutes), and a cooldown (stretching). Load regulation was based on the FITT principles (frequency, intensity, time, and type of exercise), with exercise intensity maintained at 65-85% of the maximum heart rate. Individualisation was ensured through baseline test results, data obtained from fitness trackers worn daily by students throughout the experimental period, and subjective well-being indicators. The exercises were selected to ensure comprehensive physical development and safe performance in home-based conditions. The choice of a comprehensive methodology was determined by the need for interactive learning, personalisation of physical load in accordance with students' levels of physical fitness, and the possibility of real-time monitoring of physical activity, in contrast to the traditional model, which is predominantly based on passive perception of educational material.

For the objective assessment of physical fitness development, a measurement method was applied through standardised testing conducted at the beginning and at the end of the study. The testing included the standing long jump (speed-strength abilities), the Cooper test (endurance), the number of trunk lifts performed in 30 seconds (abdominal muscle strength), and the forward trunk bend (flexibility). To ensure objectivity, which is a critically important aspect of distance learning, students in the EG used portable fitness trackers, Xiaomi Smart Band 8 (China), for the daily measurement of physical activity indicators, specifically step counts. Questionnaire surveys were administered before the beginning and after the completion of the experiment. A single research instrument was applied, namely an author-developed questionnaire designed on the Google Forms platform (USA). It consisted of 12 items covering the level of interest in classes, motivation to perform exercises, and satisfaction with the organisation of distance learning. Sample questions included: "How capable are you of organising and monitoring your own learning?", "How satisfied are you with distance learning in physical education?", and "How would you assess the effectiveness of the lesson methodology?". A five-point Likert scale was employed, and the criterion for a high or positive assessment was established by combining the responses "high/very high" or "positive/very positive".

A set of statistical methods was applied for the processing of both subjective and objective data. The collection of subjective data (motivation and satisfaction) was carried out using the above-mentioned author-developed questionnaire. Prior to analysis, the normality of data distribution was verified using the Shapiro-Wilk test. The comparative method was used to assess the initial level of preparedness of the groups, the dynamics of improvement within the CG and EG, and the comparison of final results between the groups. Student's t test was applied to compare mean values, while the chi-square (χ^2) test was used for the analysis of categorical questionnaire data in order to determine the statistical significance of changes in the responses of the CG and EG before and after the experiment. The relationship between activity indicators obtained from fitness trackers and physical fitness indicators was assessed using Pearson's correlation coefficient. The processing of fitness tracker data involved averaging daily indicators over the entire experimental period. Statistical analysis was performed using Statistica 13 (USA). The level of statistical significance was set at $p < 0.05$, and the results are presented in the format $X \pm SD$.

Results and Discussion

Impact of the comprehensive methodology on students' physical fitness

The results of this comparison, illustrating changes in physical fitness parameters across four main aspects (speed-strength abilities, endurance, abdominal muscle strength, and flexibility) at the beginning and at the end of the experiment, are presented in Table 1 below.

Table 1. Comparative analysis of physical fitness indicators in the CG and EG at the beginning and at the end of the experiment

Indicator	Group	Beginning of the experiment ($\bar{X} \pm SD$)	End of the experiment ($\bar{X} \pm SD$)	Increase (%)	Student's t test	p
Standing long jump (cm)	CG (n = 60)	198.4\7.1	200.8\7.5	1.2	t = 0.89	$p > 0.05$
	EG (n = 60)	197.9\6.9	210.1\8.4	6.2	t = 4.12	$p < 0.01$
Cooper test (m)	CG (n = 60)	2,150\125	2,185\130	1.6	t = 1.05	$p > 0.05$
	EG (n = 60)	2,160\128	2,350\145	8.8	t = 5.78	$p < 0.001$

Table 1, Continued

Indicator	Group	Beginning of the experiment ($\bar{X} \pm SD$)	End of the experiment ($\bar{X} \pm SD$)	Increase (%)	Student's *t* test	*p*
Abdominal muscle strength (number of repetitions/30 s)	CG ($n = 60$)	32.1\3.5	33.5\3.7	4.4	$t = 1.50$	$p > 0.05$
	EG ($n = 60$)	32.5\3.6	38.9\4.1	19.7	$t = 6.91$	$p < 0.001$
Flexibility (forward trunk bend, cm)	CG ($n = 60$)	8.5\1.2	8.8\1.3	3.5	$t = 0.75$	$p > 0.05$
	EG ($n = 60$)	8.3\1.1	10.4\1.4	25.3	$t = 5.15$	$p < 0.01$

Source: created by the authors

A detailed analysis of the quantitative results presented in Table 1 made it possible to objectively evaluate the effectiveness of the comprehensive distance learning methodology in physical education implemented in the EG, in comparison with the traditional approach applied in the CG. The baseline testing data demonstrated that, at the beginning of the experiment, no statistically significant differences were observed between the CG and EG for any of the indicators (all $p > 0.05$). This confirms the homogeneity of the sample and its suitability for conducting a comparative study. The analysis of the results after the completion of the formative experiment revealed fundamentally different dynamics in the two groups. In the control group, which was taught according to the standard distance learning model with limited feedback, the increase in indicators was minimal and, importantly, statistically insignificant across all four dimensions ($p > 0.05$). For example, the standing long jump improved by only 1.2% (from 198.4\7.1 cm to 200.8\7.5 cm), while the Cooper test result increased by 1.6%, that is, from 2,150\125 m to 2,185\130 m.

In contrast, the experimental group, which applied the comprehensive methodology incorporating individualisation of physical load, synchronous sessions, and digital monitoring, demonstrated statistically significant and substantially greater improvements across all tested indicators. The most pronounced progress was observed in flexibility, where the increase reached 25.3%, namely from 8.3\1.1 cm to 10.4\1.4 cm ($p < 0.01$), and in abdominal muscle strength, which increased by 19.7%, from 32.5\3.6 to 38.9\4.1 repetitions per 30 seconds ($p < 0.001$). The marked improvement in abdominal muscle strength is particularly indicative, as this parameter is highly dependent on the regularity and intensity of the training process. This result is consistent with the findings of M. Sanz-Matesanz *et al.* (2024), who demonstrated that even a specialised physical training programme exerts a positive effect on both physical and cognitive performance. The endurance indicator (Cooper test) increased by 8.8%, specifically from 2,160\128 m to 2,350\145 m ($p < 0.001$), demonstrating the effectiveness of individualised running and cardio programmes, which were monitored using fitness trackers. Even in a metric traditionally challenging for distance learning, such as the standing long jump – which reflects the development of speed-strength abilities – an increase of 6.2% was recorded, with the mean value rising from 197.9\6.9 cm to 210.1\8.4 cm.

A comparison of the final results between the EG and the CG confirmed the statistical superiority of the comprehensive methodology applied in the EG. Across all four indicators, the final results of the EG were significantly higher than those of the CG, and these differences were highly significant. These findings demonstrate that the effectiveness of distance learning in physical education can be enhanced to a level comparable with traditional approaches, provided that specialised methodological and technological solutions are employed. The use of technology for personalisation and real-time monitoring proved to be a key factor, which aligns with the projections of P.S. Aithal *et al.* (2024), who emphasised the growing role of technology in the future of higher education and the necessity of its implementation to improve learning quality. Furthermore, the outcomes of the experimental group highlighted the importance of active leadership and an innovative approach in educational management, a point also emphasised by G. Maheshwari *et al.* (2024), who analysed the impact of e-leadership on staff performance in higher education institutions.

In summary, the results of the pedagogical experiment not only demonstrated the superiority of the developed comprehensive methodology over the traditional distance learning model but also highlighted that approaches based on technological monitoring and individualisation can achieve substantial improvements in students' physical fitness even under remote learning conditions. In the context of barriers described by S.A.J. Phulpoto *et al.* (2024) regarding e-learning, the comprehensive methodology applied in the EG successfully overcame many of these obstacles, transforming technology from a potentially problematic element into an effective tool for the educational process.

The alignment of these findings with the conclusions of S.A.J. Phulpoto *et al.* (2024) illustrates improvements in teaching effectiveness within the context of e-learning at public universities in Pakistan. The authors emphasised that high achievements in e-learning systems are attainable only through the systematic elimination of organisational barriers, the provision of reliable digital infrastructure, and the creation of an environment in which educators receive support for the application of innovative approaches. Similarly, C. Tejeda-Delgado *et al.* (2011), analysing cultural aspects of learning, highlighted the critical importance of aligning the educational environment with student expectations and ensuring regular, high-quality feedback to compensate for the absence of direct interaction. The success of distance learning, therefore, depends on the integration of technology, methodology, and psychology, which together form a new educational landscape. The present study corroborates these findings, demonstrating that a technologically and administratively supported model of remote learning can reliably produce significant improvements in students' academic achievements.

Digital monitoring of physical fitness in students of the Faculty of Arts, Management, Pedagogy, and Psychology at Hryhorii Skovoroda University in Pereiaslav

Contemporary academic discourse emphasises the necessity of digital transformation in higher education and the

integration of technologies to enhance learning effectiveness, particularly under distance learning conditions. The shift to online education, prompted by global crises, has highlighted a key challenge: maintaining the practical orientation of disciplines such as physical education without direct educator supervision. In this context, M. Akour & M. Alenezi (2022), analysing the future of higher education in the era of digital transformation, emphasised that the success of distance learning depends on the implementation of tools that allow the objectification of both the learning process and its outcomes. The use of portable technologies and fitness trackers represents a key mechanism for addressing the problem of the absence of physical contact, enabling continuous measurement of students' physical activity. Additionally, the importance of a physical learning environment for distance learners in higher education is recognised as a critical factor influencing both psychological and physical well-being (Ng, 2021). Table 2 below presents the results of a correlation analysis between the average daily step count recorded for students in the EG during the experiment and the relative percentage increase (%) in their physical fitness indicators.

Table 2. Correlation analysis of the relationship between physical activity

Indicator of physical fitness increase	Pearson correlation coefficient (r)	Significance level (p)	Strength and direction of the relationship
Increase in standing long jump (%)	0.58	$p < 0.01$	Moderate, positive
Cooper test increase (%)	0.72	$p < 0.001$	High, positive
Increase in abdominal muscle strength (%)	0.65	$p < 0.01$	Moderate, positive
Flexibility increase (%)	0.41	$p < 0.05$	Weak, positive

Source: created by the authors

The analysis presented in Table 2 allows for the quantification of relationships between the objective measurement of physical activity in students of the EG (average daily step count) and the effectiveness of the applied comprehensive distance learning methodology, as expressed by the relative increase in physical fitness indicators. During the experimental period, the EG achieved an average of 9,850 ± 1,120 steps per day, considerably higher than the WHO-recommended 6,000-8,000 steps for maintaining health, indicating the success of the methodology in promoting physical activity (Elgin, 2025).

The Pearson correlation analysis demonstrated a direct and statistically significant relationship between average daily steps and improvements across all tested physical fitness qualities. The strongest correlation was observed between step count and endurance improvement (Cooper test), with a correlation coefficient of $r = 0.72$ ($p < 0.001$). This high correlation indicates that students who maintained higher levels of daily activity, as recorded by fitness trackers, achieved the greatest improvements in aerobic endurance. These results highlight the necessity of implementing objective monitoring of students' physical activity in distance education, providing a means to overcome limitations previously identified by N. Martynova & E. Kuzko (2021). Unlike the previously identified problem of insufficient supervision of practical activity, the applied methodology provided systematic and transparent monitoring of physical activity, which substantially enhanced the effectiveness of organising the learning process.

The increases in strength-related qualities, specifically abdominal muscle strength ($r = 0.65$, $p < 0.01$) and speed-strength abilities, as measured by the standing long jump ($r = 0.58$, $p < 0.01$), also showed a moderate but significant positive correlation with step count. This indicates that overall physical activity, even when non-specific (such as walking), serves as an important background factor in the development of these qualities within the context of the comprehensive training programme implemented in the EG. The strong correlation confirms that, in a distance learning environment where the lecturer cannot continuously monitor exercise performance, maintaining high overall physical activity through tools such as fitness trackers is an effective mechanism for promoting performance outcomes. The weakest, although still statistically significant, correlation was observed between step count and improvements in flexibility ($r = 0.41$, $p < 0.05$). This finding is physiologically consistent: walking has a limited effect on flexibility, which primarily depends on the performance of specialised stretching exercises. Nevertheless, the positive correlation suggests that general physical activity and participation in the training regimen, even indirectly, contribute to improvements in this quality as well.

Overall, the results of the correlation analysis empirically support the necessity and effectiveness of using digital measurement tools (fitness trackers) to enhance both the objectivity and the outcomes of distance learning in physical education. It has been confirmed that technological monitoring and individualisation of physical load contribute to an increase in overall physical activity, which in turn leads to a significant improvement in physical fitness. Within the broader research context, for example, L. Zhang *et al.* (2022), who conducted a literature review on online learning during COVID-19, the present study adds concrete empirical evidence showing how technology can be used not only to deliver information but also to objectively monitor physical progress – a factor critical to maintaining quality in times of crisis. The findings also align with the recommendations of W. Ali (2020), who emphasised the need for a rapid and effective transition to remote learning, stressing that institutions must identify ways to ensure learning effectiveness. The methodology applied in the EG, based on continuous measurement and correlational analysis of data, demonstrated one such approach. The presence of significant correlations confirmed that individualised tasks, which required a specified level of daily activity, were successfully integrated into students' routines, resulting in a statistically significant increase in physical fitness indicators – an outcome not observed in the CG. This, in turn,

provides evidence of the effectiveness of the comprehensive methodology as a mechanism for overcoming the challenges of physical remoteness and maintaining the integrity of the physical education process in higher education institutions. The successful implementation of flipped classrooms in higher education during the pandemic, as examined by B. Divjak *et al.* (2022), further emphasises that independent student work – which forms the core of distance learning – can be highly effective if clearly structured and monitored, as was achieved here through digital measurement of physical activity.

Satisfaction indicators with online physical education in the control and experimental groups

The analysis of subjective data collected through the author-designed questionnaire allows for a comparison of the psychological and motivational profiles of students in the control group and the experimental group. To identify statistically significant differences between the groups for categorical variables (levels of satisfaction, motivation, and autonomy), the Chi-square test was applied. The results, together with the percentage distribution of responses, are presented in detail in Table 3.

Table 3. Comparative analysis of students' subjective indicators of satisfaction and motivation in distance learning

No.	Questionnaire item	Criterion for a positive response	CG before ($N = 60$)	CG after ($N = 60$)	EG before ($N = 60$)	EG after ($N = 60$)	χ^2 ($df = 1$)	p
1	How satisfied are you with distance learning in physical education?	High/medium level of satisfaction	18 (30%)	20 (33%)	16 (27%)	38 (63%)	27.9	$p < 0.001$
2	How would you assess the effectiveness of the lesson methodology?	Positive/very positive	15 (25%)	16 (27%)	14 (23%)	45 (75%)	35	$p < 0.001$
3	Evaluate your intrinsic motivation for physical education	High/very high level	17 (28%)	18 (30%)	15 (25%)	42 (70%)	22.5	$p < 0.001$
4	How capable are you of organising and monitoring your own learning?	High/very high level of autonomy	22 (37%)	24 (40%)	20 (33%)	48 (80%)	19.2	$p < 0.001$
5	Do you consider the physical load appropriate to your fitness level?	Yes (adequate)	28 (47%)	30 (50%)	27 (45%)	51 (85%)	18.7	$p < 0.001$
6	Would you like to continue learning in a distance format?	Yes (if the methodology is effective)	8 (13%)	9 (15%)	10 (17%)	33 (55%)	22.5	$p < 0.001$
7	How much support do you feel from the lecturer during classes?	High/medium level of support	25 (42%)	28 (47%)	24 (40%)	52 (87%)	26.8	$p < 0.001$
8	How easy was it to use digital tools (Moodle, Google Meet)?	Easy/very easy	35 (58%)	38 (63%)	34 (57%)	55 (92%)	15.6	$p < 0.001$
9	Did you receive sufficient feedback on exercise performance?	Yes (sufficient)	12 (20%)	14 (23%)	15 (25%)	40 (67%)	27.5	$p < 0.001$
10	Did you feel socially isolated during distance learning?	No (low level of isolation)	20 (33%)	22 (37%)	21 (35%)	49 (82%)	24.3	$p < 0.001$
11	Does the flexible class schedule meet your needs?	Fully/mostly meets	30 (50%)	32 (53%)	31 (52%)	54 (90%)	21.6	$p < 0.001$
12	Did the lessons contribute to an increase in your overall physical activity, according to your tracker?	Yes (contributed)	-	-	26 (43%)	53 (88%)	23.5	$p < 0.001$

Source: created by the authors

The data in Table 3 revealed a marked difference between the control and experimental groups in the dynamics of subjective indicators. For overall satisfaction with distance learning (Question 1), students in the CG exhibited minimal change (from 30% to 33%). In contrast, the EG showed a sharp increase in positive responses from 27% to 63%, which was statistically significant ($\chi^2 = 27.9$, $p < 0.001$). The high level of significance indicates a pronounced positive impact of the proposed methodology. This finding aligns with international research by P. Fidalgo *et al.* (2020), who emphasised that positive evaluations of distance learning depend on course structure quality, pedagogical support, and timely feedback.

A similar trend was observed for the assessment of methodology effectiveness (Question 2), where changes in the CG were minimal (25% → 27%), whereas the EG demonstrated an increase from 23% to 75% ($\chi^2 = 35.0$, $p < 0.001$). This result reflects the subjectively perceived pedagogical effectiveness of the course. These findings are consistent with those of S. Elfirdoussi *et al.* (2020), who found that students rated distance courses more positively when they included clear instructions and well-structured materials. Particularly noteworthy is the indicator of intrinsic motivation for physical education (Question 3), which is traditionally difficult to enhance in a distance learning format. In the CG, the indicator of intrinsic motivation remained almost unchanged (28% → 30%), whereas in the EG it increased substantially from 25% to 70% ($\chi^2 = 22.5$, $p < 0.001$). This finding aligns with the results of M. Rizun & A. Strzelecki (2020), who demonstrated that motivation for online learning is strongly influenced by feelings of engagement, autonomy, and personalisation. The rise in motivation indicates an effective restructuring of the learning environment. The fourth indicator, students' ability to organise their own learning independently (Question 4), also revealed a significant gap. In the CG, growth was minimal (37% → 40%), whereas in the EG, there was a dramatic increase from 33% to 80% ($\chi^2 = 19.2$, $p < 0.001$). The

improvement in autonomy supports the theoretical conclusion of M. Barak (2012) that organisational transformation should position students as active participants in the learning process. The fifth indicator, the perceived adequacy of the physical load (Question 5), reflected a balance between the objective difficulty of the exercises and the students' subjective capacity. The CG showed only a slight improvement (47% → 50%), whereas the EG increased from 45% to 85% ($\chi^2 = 18.7$, $p < 0.001$). This outcome aligns with the study by M. Allen *et al.* (2006), which concluded that the effectiveness of distance programmes depends on adapting the learning material to students' individual abilities. The sixth indicator, willingness to continue learning in a distance format (Question 6), demonstrated the clearest overall improvement. In the CG, changes were minimal (13% → 15%), while in the EG they were substantial, rising from 17% to 55% ($\chi^2 = 22.5$, $p < 0.001$). In turn, this indicates that the implemented methodology enhanced the motivational, emotional, and organisational aspects of learning, fostering a sustained desire to continue studying. This conclusion aligns with the findings of S.A. Aljawarneh (2020), who demonstrated that a key advantage of innovative ubiquitous learning tools is their ability to maintain prolonged student engagement.

Analysis of the additional questions (7-12) reinforces these conclusions. Regarding lecturer support (Question 7), the EG showed an increase from 40% to 87% ($\chi^2 = 26.8$, $p < 0.001$), highlighting the crucial role of synchronous communication and individualisation. Feedback provision (Question 9) also rose in the EG from 25% to 67% ($\chi^2 = 27.5$, $p < 0.001$), a factor recognised as essential for course quality by P. Fidalgo *et al.* (2020). Of particular note is the result concerning social isolation (Question 10), where the proportion of students in the EG reporting no feelings of isolation increased from 35% to 82% ($\chi^2 = 224.3$, $p < 0.001$), confirming the effectiveness of the methodology's interactive elements in promoting social engagement. Similarly, the indicator for contributing to overall physical activity (Question 12) rose in the EG to 88% ($\chi^2 = 223.5$, $p < 0.001$), supporting the efficacy of fitness trackers and individualised exercise loads. The experimental results are fully consistent with theoretical models of distance education and confirm that the effectiveness of online learning is determined by the quality of pedagogical decisions. At the same time, comparison with the study by I.A. Adeoye *et al.* (2020) shows that, in the absence of methodological preparation, even simple online tasks can become challenging. This provides grounds to interpret the present findings as evidence that the enhanced methodology significantly improves the effectiveness of distance learning. The comparative analysis of subjective indicators convincingly demonstrates the high effectiveness of the developed comprehensive distance-learning methodology for the EG. The substantial and statistically significant increases across all 12 questionnaire parameters (ranging from 15.6 to 35.0, $p < 0.001$) reflect improvements in satisfaction, intrinsic motivation, autonomy, perceived support, and the adequacy of workload. These findings indicate that the integration of synchronous communication and digital monitoring compensated for the limitations of the distance-learning format and fostered a new, more effective educational culture, aligning with the key theoretical positions of M. Barak (2012) and P. Fidalgo *et al.* (2020) regarding the critical role of pedagogical support and student autonomy in online education.

Summarising the outcomes of the study, it is evident that the implementation of the developed comprehensive methodology for distance learning in physical education produced a systematic positive effect on all key components of the educational process in the experimental group. Observed changes include increases in student satisfaction, intrinsic motivation, and the development of autonomy, self-awareness, and responsibility for organising their own learning and physical activity. The combination of synchronous pedagogical guidance, structured learning content, and elements of digital monitoring created conditions to overcome characteristic limitations of the distance-learning format, such as reduced social interaction and insufficient feedback. The results confirm that the effectiveness of distance learning is determined not by the format itself, but by the quality of pedagogical decisions, their adaptability to student needs, and their ability to ensure active engagement in the learning process.

Conclusions

The empirical study, aimed at analysing the effectiveness of distance learning in physical education at a higher education institution, established and quantitatively confirmed the advantages of a comprehensive methodology that integrated digital monitoring technologies with individualised workloads over the traditional distance learning model. The research demonstrated that the application of this innovative approach produces a statistically significant improvement in objective measures of students' physical fitness and substantially enhances their subjective perception of the learning process. The results of the pedagogical investigation indicate that when distance learning is organised effectively, its outcomes are comparable to those of traditional face-to-face formats. Students in the EG showed statistically significant improvements across all tested indicators ($p < 0.01$ or $p < 0.001$), whereas increases in the CG were not statistically significant. The greatest improvements in the EG were observed in flexibility (25.3%) and abdominal muscle strength (19.7%), while endurance (Cooper Test) increased by 8.8%. These findings indicate that continuous digital monitoring and programme individualisation effectively stimulate the training process, which standard distance-learning arrangements do not provide.

Analysis of the data collected via fitness trackers in the EG revealed a direct and statistically significant correlation between the average daily step count and the gains in physical fitness indicators. The strongest correlation was observed with endurance ($r = 0.72$, $p < 0.001$), unequivocally confirming that objective measurement of physical activity is a significant factor in the development of physical abilities in the context of distance learning. Evaluation of the experimental results demonstrated a clear and consistent advantage of the experimental methodology over the traditional distance-learning format. All six indicators showed substantial improvement: in the experimental group, overall satisfaction increased from 27% to 63%, perceived effectiveness from 23% to 75%, intrinsic motivation from 25% to 70%, independent organisation of learning from 33% to 80%, adequacy of physical workload from 45% to 85%,

and the overall composite indicator rose from 17% to 55%. This dynamic confirms that the revised methodology had a marked positive effect on the emotional, motivational, and organisational aspects of distance learning.

The limitations of this study pertain to the sampling method, as a non-probability (convenience) sample was utilised, thereby restricting the direct extrapolation of the results to the broader population of higher education students. Furthermore, despite the implementation of fitness trackers, maintaining comprehensive oversight of exercise technique within a distance learning context remains a persistent challenge. Future research should focus on evaluating the long-term effects of the comprehensive methodology on students' health-preserving competence and physical activity, employing a larger sample and comparing different models of digital monitoring, including mobile applications with AI-assisted correction.

Acknowledgements

None.

Funding

None.

Conflict of Interest

None.

References

[1] Adeoye, I.A., Adanikin, A.F., & Adanikin, A. (2020). COVID-19 and e-learning: Nigeria tertiary education system experience. *International Journal of Research and Innovation in Applied Science*, 5(5), 28-31.
[2] Aithal, P.S., Prabhu, S., & Aithal, S. (2024). Future of higher education through technology prediction and forecasting. *Poornaprajna International Journal of Management, Education, and Social Science*, 1(1). doi: 10.2139/ssrn.4901474.
[3] Akour, M., & Alenezi, M. (2022). Higher education future in the era of digital transformation. *Education Sciences*, 12(11), article number 784. doi: 10.3390/educsci12110784.
[4] Alarifi, B.N., & Song, S. (2024). Online vs in-person learning in higher education: Effects on student achievement and recommendations for leadership. *Humanities and Social Sciences Communications*, 11, article number 86. doi: 10.1057/s41599-023-02590-1.
[5] Alenezi, M. (2023). Digital learning and digital institution in higher education. *Education Sciences*, 13(1), article number 88. doi: 10.3390/educsci13010088.
[6] Ali, W. (2020). Online and remote learning in higher education institutes: A necessity in light of COVID-19 pandemic. *Higher Education Studies*, 10(3), 16-25. doi: 10.5539/hes.v10n3p16.
[7] Aljawarneh, S.A. (2020). Reviewing and exploring innovative ubiquitous learning tools in higher education. *Journal of Computing in Higher Education*, 32(1), 57-73. doi: 10.1007/s12528-019-09207-0.
[8] Allen, M., Mabry, E., Mattrey, M., Bourhis, J., Titsworth, S., & Burrell, N. (2006). Evaluating the effectiveness of distance learning: A comparison using meta-analysis. *Journal of Communication*, 54(3), 402-420. doi: 10.1111/j.1460-2466.2004.tb02636.x.
[9] Barak, M. (2012). Distance education: towards an organizational and cultural change in higher education. *Journal of Enterprising Communities: People and Places in the Global Economy*, 6(2), 124-137. doi: 10.1108/17506201211228930.
[10] Bashir, S., & Lapshun, A.L. (2025). E-learning future trends in higher education in the 2020s and beyond. *Cogent Education*, 12(1), article number 2445331. doi: 10.1080/2331186X.2024.2445331.
[11] Bondarenko, I.G., Andriushchenko, M.I., Mayer, V.Ya., Kurasa, G.O., & Bondarenko, O.V. (2020). Assessment of the effectiveness of organising distance learning for future physical education specialists. *Newsletter of Precarpathian University. Physical Culture*, 35, 3-9. doi: 10.15330/fcult.35.9-17.
[12] Code of Ethics of the American Sociological Association. (1997). Retrieved from https://www.asanet.org/wp-content/uploads/code_of_ethics.pdf.
[13] Divjak, B., Rienties, B., Iniesto, F., Vondra, P., & Žižak, M. (2022). Flipped classrooms in higher education during the COVID-19 pandemic: Findings and future research recommendations. *International Journal of Educational Technology in Higher Education*, 19(1), article number 9. doi: 10.1186/s41239-021-00316-4.
[14] Elfirdoussi, S., Lachgar, M., Kabaili, H., Rochdi, A., Goujdami, D., & El Firdoussi, L. (2020). Assessing distance learning in higher education during the COVID-19 pandemic. *Education Research International*. doi: 10.1155/2020/8890633.
[15] Elgin, J. (2025). *Just 7,000 steps a day could cut health risks, study says*. Retrieved from https://www.bbc.com/news/articles/cx238lgy3pwo.
[16] Fidalgo, P., Thormann, J., Kulyk, O., & Lencastre, J.A. (2020). Students' perceptions on distance education: A multinational study. *International Journal of Educational Technology in Higher Education*, 17(1), article number 18. doi: 10.1186/s41239-020-00194-2.
[17] Google Meet. (n.d.). Retrieved from https://meet.google.com/landing?pli=1.
[18] Haapala, E.A., Leppänen, M.H., Skog, H., Lubans, D.R., Viitasalo, A., Lintu, N., Jalanko, P., Määttä, S., & Lakka, T.A. (2024). Childhood physical fitness as a predictor of cognition and mental health in adolescence: The PANIC Study. *Sports Medicine*, 55(2), 487-497. doi: 10.1007/s40279-024-02107-z.
[19] European Commission. (2021). *On ethics and data protection*. Retrieved from https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ethics-and-data-protection_he_en.pdf.
[20] Kohli, J.K., Raj, R., Rawat, N., & Gupta, A. (2024). Development and validation of teachers'e-readiness scale: A study on higher education institutions in India. *Journal of Applied Research in Higher Education*, 17(2), 545-562. doi: 10.1108/JARHE-11-2023-0517.

[21] Maheshwari, G., Clarke, S., Nguyen, Q.A.N., McClelland, R., & Kunte, M. (2024). Effect of E-leadership on employees' outcomes in the higher education sector during COVID-19 and beyond: A case study from Vietnam. *Educational Management Administration & Leadership*, 53(6). doi: 10.1177/17411432231222715.
[22] Martynova, N., & Kuzko, E. (2021). Problems of distance learning of applicants of higher education in "Physical Culture". *Scientific Journal of the Drahomanov National Pedagogical University*, 3(131), 13-16. doi: 10.31392/NPU-nc.series%2015.2021.3%D0%9A(131).0.
[23] Moodle. (n.d.). Retrieved from https://moodle.org/?lang=uk.
[24] Moustakas, L., & Robrade, D. (2022). The challenges and realities of e-learning during COVID-19: The case of university sport and physical education. *Challenges*, 13(1), article number 9. doi: 10.3390/challe13010009.
[25] Mozolev, O. (2022). Physical education of students during the implementation of distance and blended learning. *Scientific Collection "InterConf"*, 118, 339-344.
[26] Nesterenko, O.M., Shpitun, I.I., & Babych, T.M. (2024). Innovative approaches to teaching physical education in higher education institutions: Improving the effectiveness of training and developing students' physical qualities. *Academic Visions*, 35. doi: 10.5281/zenodo.13912423.
[27] Ng, C.F. (2021). The physical learning environment of online distance learners in higher education-a conceptual model. *Frontiers in Psychology*, 12, article number 635117. doi: 10.3389/fpsyg.2021.635117.
[28] Phulpoto, S.A.J., Oad, L., & Imran, M. (2024). Enhancing teacher performance in E-learning: Addressing barriers and promoting sustainable education in public universities of Pakistan. *Pakistan Languages and Humanities Review*, 8(1), 418-429. doi: 10.47205/plhr.2024(8-I)38.
[29] Rizun, M., & Strzelecki, A. (2020). Students' acceptance of the COVID-19 impact on shifting higher education to distance learning in Poland. *International Journal of Environmental Research and Public Health*, 17(18), article number 6468. doi: 10.3390/ijerph17186468.
[30] Sanz-Matesanz, M., Martínez-Aranda, L.M., & Gea-García, G.M. (2024). Effects of a physical training program on cognitive and physical performance and health-related variables in professional esports players: A pilot study. *Applied Sciences*, 14(7), article number 2845. doi: 10.3390/app14072845.
[31] Tejeda-Delgado, C., Millan, B.J., & Slate, J.R. (2011). Distance and face-to-face learning culture and values: A conceptual analysis. *Administrative Issues Journal: Education, Practice, and Research*, 1(2), 118-131.
[32] Turnbull, D., Chugh, R., & Luck, J. (2021). Transitioning to e-learning during the COVID-19 pandemic: How have higher education institutions responded to the challenge? *Education and Information Technologies*, 26(5), 6401-6419. doi: 10.1007/s10639-021-10633-w.
[33] Zhang, L., Carter, R.A., Qian, X., Yang, S., Rujimora, J., & Wen, S. (2022). Academia's responses to crisis: A bibliometric analysis of literature on online learning in higher education during COVID-19. *British Journal of Educational Technology*, 53(3), 620-646. doi: 10.1111/bjet.13191.

Аналіз ефективності дистанційного навчання з фізичної культури у закладах вищої освіти

Наталія Пангелова

Доктор наук з фізичного виховання і спорту, професор
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
https://orcid.org/0000-0001-9133-0889

Андрій Пивовар

Кандидат наук з фізичного виховання і спорту, доцент
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
https://orcid.org/0000-0002-6157-1566

Тетяна Кравченко

Кандидат педагогічних наук, доцент
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
https://orcid.org/0000-0002-6041-3101

Анотація. Мета наукового дослідження полягала в емпіричній верифікації ефективності комплексної методики дистанційного навчання з дисципліни «Фізична культура» в освітньому процесі студентів гуманітарного профілю (факультет мистецтва, менеджменту, педагогіки і психології). Експериментальна частина дослідження була реалізована упродовж лютого-травня 2025 року на базі Університету Григорія Сковороди в Переяславі. Для досягнення мети був застосований педагогічний експеримент на вибірці студентів ($N = 120$), що включав тестування фізичної підготовленості, анкетування і кореляційний аналіз із використанням t критерію Стьюдента і тесту для встановлення статистичної значущості відмінностей між експериментальною та контрольною групами. Було встановлено, що комплексна методика дистанційного навчання із використанням синхронних занять і моніторингу забезпечувало статистично значущий приріст об'єктивних показників фізичної підготовленості ($p < 0{,}01$ або $p < 0{,}001$), що не спостерігалося у традиційній моделі дистанційного навчання. У студентів експериментальної групи зафіксовано суттєве покращення за всіма шістьма показниками: загальна задоволеність зросла з 27 % до 63 %, оцінка ефективності – з 23 % до 75 %, внутрішня мотивація – з 25 % до 70 %, самостійна організація навчання – з 33 % до 80 %, адекватність фізичного навантаження – з 45 % до 85 %, а інтегральний показник загальної оцінки підвищився з 17 % до 55 %. Усі зміни були статистично значущими ($p < 0{,}001$), що підтверджує стабільний позитивний вплив удосконаленої методики дистанційного навчання. Отримані дані свідчать про статистично значущу ефективність апробованої методики віддаленого навчання, яка забезпечує позитивну динаміку розвитку фізичних якостей студентів. Встановлено високий ступінь взаємозв'язку між рівнем щоденної фізичної активності та показниками стійкості. Крім того, кількісний аналіз підтвердив суттєве зростання рівня внутрішньої мотивації та задоволеності навчанням в експериментальній групі. Ці результати мають практичну значущість для оптимізації процесу дистанційного фізичного виховання у ЗВО

Ключові слова: цифрова трансформація; рухова активність; здоров'я; демотивація; освітній процес; фізичні якості