Enhancing physical education through technology and freestyle wrestling: impact on elementary school students' activity, engagement and motivation

Mejorar la educación física a través de la tecnología y la lucha libre: impacto en la actividad, el compromiso y la motivación de los estudiantes de la escuela primaria

Authors

Batyrbek Mendigaliyev[1]
Yernar Ospankulov[1]
Nazerke Kaden[1]
Laura Orynbayeva[1]
Rakhym Bayaliyev[1]
Aziza Zhunusbekova[1]
Aizhan Nurgaliyeva[1]

[1] Abai Kazakh National Pedagogical University (Kazakhstan)

Corresponding author:
Aizhan Nurgaliyeva
n.a.e.89@mail.ru

How to cite in APA

Mendigaliyev, B., Kaden, N., Kaden, N., Ospankulov., Yernar., Kaden, N., Orynbayeva, L.., ... Nurgaliyeva, A. (2025). Enhancing Physical Education through Technology and Freestyle Wrestling: Impact on Elementary School Students' Activity, Engagement and Motivation . *Retos*, *69*, 118–131. https://doi.org/10.47197/retos.v69.114212

Abstract

Introduction: Both society and the educational community have shown a discernible increase in interest in educational technologies in recent years. Technology has a big influence on education overall, but there are a lot of questions and concerns about how it will be used in physical education.
Objective: The study aims to assess a technology-enhanced physical education program that incorporates freestyle wrestling techniques to improve elementary school students' physical activity, engagement and motivation.
Methodology: This study was conducted using a quantitative method, the author's questionnaire. A total of 108 participants participated in the study; they were from primary schools.
Results: The diagnostic study's findings conclude that students' interest in freestyle wrestling instruction was rather high. Another basis for developing the methodology was the results of the conducted ascertaining experiment on the level of physical fitness of schoolchildren aged 9–10.
Discussion: It was revealed that the attitude of students toward regulated physical education classes in elementary schools is mostly negative.
Conclusions: These findings suggest that, in comparison to traditional physical education, the technology-enhanced program that incorporated freestyle wrestling techniques significantly improved the physical activity, engagement, and motivation of elementary school pupils.

Keywords

Activity; enhancing; engagement; elementary school; impact; freestyle wrestling; physical education.

Resumen

Introducción: Tanto la sociedad como la comunidad educativa han mostrado un aumento notable en el interés por las tecnologías educativas en los últimos años. La tecnología tiene una gran influencia en la educación en general, pero existen muchas preguntas e inquietudes sobre su uso en la educación física.
Objetivo: El estudio tiene como objetivo evaluar un programa de educación física mejorado con tecnología que incorpora técnicas de lucha libre para mejorar la actividad física, el compromiso y la motivación de los estudiantes de primaria.
Metodología: Este estudio se realizó utilizando un método cuantitativo, mediante un cuestionario elaborado por el autor. Un total de 108 participantes de escuelas primarias participaron en el estudio.
Resultados: Los hallazgos del estudio diagnóstico concluyen que el interés de los estudiantes en la instrucción de lucha libre fue bastante alto. Otra base para el desarrollo de la metodología fueron los resultados del experimento de diagnóstico realizado sobre el nivel de condición física de los escolares de entre 9 y 10 años.
Discusión: Se reveló que la actitud de los estudiantes hacia las clases reguladas de educación física en las escuelas primarias es mayormente negativa.
Conclusiones: Estos hallazgos sugieren que, en comparación con la educación física tradicional, el programa mejorado con tecnología que incorporó técnicas de lucha libre mejoró significativamente la actividad física, el compromiso y la motivación de los alumnos de primaria.

Palabras clave

Actividad; mejora; compromiso; escuela primaria; impacto; lucha libre; educación física.

Introduction

Developing innovative solutions to physical education (PE) challenges and refining physical exercise methodologies are essential for successfully implementing PE programs for young schoolchildren (Braga et al., 2017; Deng et al., 2024; García-Rico et al., 2021; Xie, 2021). Cutting-edge technologies play a crucial role in improving students' functional fitness and ensuring that every child maintains a sufficient level of physical health throughout their schooling (Almusawi et al., 2021; Phelps et al., 2021; Wyant & Baek, 2019).

Researchers emphasize the need to modernize PE by updating its structure, curriculum, and teaching methods to boost student motivation and participation (Gawrisch et al., 2020; Jones et al., 2017; Krause et al., 2020). For elementary school students to benefit from effective and high-quality PE, they must practice physical skills across various goal-oriented activities (Zheng et al., 2023; Bermejo-Cantarero et al., 2021). These activities support harmonious physical development and enable students to perform a variety of motor tasks (Kequn et al., 2025).

Creating appropriate learning environments tailored to children's physical needs has become increasingly important. Educators must adopt pedagogical technologies and health-preserving strategies to maintain a balance between physical activity and educational content, especially within innovative educational systems (Chen et al., 2022; Haleem et al., 2022).

One major challenge remains: understanding how to effectively integrate technology into PE (Wyant et al., 2024; Zha et al., 2025). Many experts question the feasibility of such efforts, citing a lack of technical resources, infrastructure, institutional support, and government backing (Gao & Lee, 2019). Nevertheless, successful integration depends on several key factors: well-trained teachers, access to equipment and software, and the ability to create engaging, student-centered learning environments (Chen et al., 2019; Xing & Qi, 2023). Ongoing research must continue evaluating the effectiveness of technology in PE to identify best practices and guide future implementation.

Problem Statement

The reform of the comprehensive school in Kazakhstan predetermined the development of new programs for all subjects studied, including PE. The selection of the optimal composition of means and methods of PE presupposes, in turn, the improvement of the established methodology for managing the process of physical education of schoolchildren. However, growing concerns about students' health are largely linked to the poor organization of physical education under current school programs (Ospankulov et al., 2023; Kuralbayeva et al., 2025).

Primary education is not merely a stage in lifelong learning—it is the foundation of formal schooling. Therefore, it was first affected by all kinds of innovations and changes at all levels (at school, regional, and state) (Nurgaliyeva et al., 2023). Today, the deterioration of the health of primary school students is especially alarming. The modern school is overloaded with various experiments: new technologies, author's programs are being introduced, and second-generation standards are being tested. These changes have led to violations of health standards, overly intense and poorly structured learning processes, and a rise in illnesses among schoolchildren. One of the main reasons is the unsatisfactory setting of physical education in elementary schools. It is evidenced by the low level of development of students' basic physical qualities (strength, speed, and endurance), which primarily determine the morphofunctional state of a person. It is the morphofunctional state that determines the potential of both physical health and health in general. These negative trends require radical changes in the process of PE of schoolchildren, starting from the younger grades (Nurgaliyeva et al., 2024; Redondo Tébar et al., 2025).

This study is important because it provides empirical evidence on how technology incorporating freestyle wrestling techniques in PE programs increases primary school students' physical activity, engagement and motivation, a critical yet unexplored area in Kazakhstani primary education (Tajibayeva et al., 2023; Botagariyev et al., 2024). No prior studies have examined the impact of a technology-enhanced PE program incorporating freestyle wrestling on elementary students' physical activity, engagement, and motivation. While previous studies have primarily focused on the overall effectiveness of the curriculum, this study examines how to integrate technology incorporating freestyle wrestling techniques into primary school physical education programs (Karibaev et al., 2024). The novelty of this study lies in its focus on the relationship between technology incorporating freestyle wrestling techniques and

increased physical activity (PA), engagement, and motivation in physical education among students, an area that has been largely unexplored in Kazakhstan. By utilizing technology incorporating freestyle wrestling techniques in student learning programs and survey analysis, this study provides a quantitative, evidence-based perspective for curriculum development that combines traditional methods with modern technology incorporating freestyle wrestling techniques. Therefore, the following research questions guide our study:

Q1: How does the use of technology that integrates freestyle wrestling techniques affect students' physical activity, engagement and motivation?

Q2: What differences in physical activity, motivation, and engagement outcomes exist between students in technology incorporating freestyle wrestling techniques and conventional physical education?

Q3: How do gender differences influence the effectiveness of a technology-enhanced physical education program incorporating freestyle wrestling techniques on primary school students' physical activity, engagement and motivation?

Accordingly, the study aims to assess a technology-enhanced physical education program that incorporates freestyle wrestling techniques to improve elementary school students' physical activity, engagement and motivation.

Method

Study Design

An experimental design was used in which the interaction of two or more variables is studied under controlled conditions and the presence of a correlation between them and their influence on the studied groups is revealed. To obtain reliable results, a valid sample was formed. Experimental group (EG) and control group (CG) were identified. Then, the variables influencing the process under study were taken into account. To identify the variables and understand how they interact, research questions were formulated. The study consisted of several successive stages.

The first stage focused on a literature review and analysis of its current state. At this stage, the goal, objectives, and hypothesis of the study were formulated.

The second stage consisted of testing the hypothesis and refining the main provisions in order to clarify and confirm them. This included establishing the experimental methodology and choosing control activities to raise fourth-grade students' physical development, engagement, and motivation levels. For two months (September–October), a preliminary experiment was conducted with students to determine more effective and age-appropriate exercises, considering the volume of the load. It was necessary to determine what volume of freestyle wrestling techniques should be included in the experimental program in its main part.

The third stage included an experiment to evaluate the effectiveness of PE classes conducted based on the developed methodology. The control group continued classes according to the standard PE program.

The participants' data were anonymous and securely stored. Safety measures were taken: instructors supervised students' physical activity to prevent injuries and ensure that the intervention was age-appropriate.

Research Method

This study was conducted based on a quantitative method, using the author's questionnaire. The level of physical activity, engagement, and motivation of students in two groups was measured before and after the intervention.

Participants

The study was conducted in Almaty city, South Kazakhstan region, located in the southern part of Kazakhstan. Participants were selected using criteria purposive sampling: (1) primary school students aged 9–10 years, (2) fourth-grade students, (3) no physical limitations, and (4) consent of parents and

guardians. A total of 108 participants participated in the study; they were from primary schools (the language of instruction was Kazakh). Table 1 shows the study participants' information.

Table 1. Demographic information of 4th grade students

Variable	EG (n = 52)	CG (n = 56)
Grade level	4th Grade	4th Grade
Age (years), mean ± SD	9.2 ± 0.8	9.3 ± 0.7
Male, n (%)	28 (53.8%)	26 (46.4%)
Female, n (%)	24 (46.2%)	30 (53.6%)

Referring to Table 1, the baseline demographic data for EG and CG demonstrate that the groups were comparable before the intervention. The mean ages are very similar—9.2 ± 0.8 years for the EG and 9.3 ± 0.7 years for the CG—indicating that the students in both groups are at a similar developmental stage. Compared to the control group, which has 46.4% more men and 53.6% more women, the EG group has 53.8% more men and 46.2% more women. This nearly equal gender distribution lowers the possibility of gender-related biases in the results by indicating that both groups are gender-balanced.

Procedure

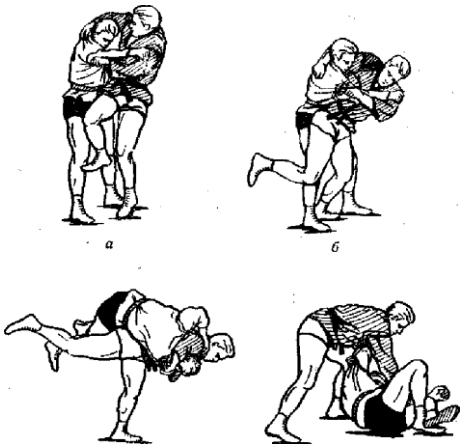
This experiment's site is Secondary School No. 182 and Secondary School No. 168 (Almaty, Kazakhstan). The specific location is the fourth-grade classrooms in an elementary school. Their age, gender, number, and learning ability are all relatively similar, laying the foundation for the smooth progression of the experiment. The specific time frame is September to December 2024, with 32 class hours. The program lasted 16 weeks, and the specific learning period was Tuesday and Thursday from 14:00 to 16:45 am and 45-minute classes. Subject area: "Physical education". A diagnostic of the results of the participants in the two groups is administered before and after the experiment begins and ends, respectively, and the specific classroom conditions of the groups of participants studied during the experiment are documented. The experimental group receives additional instruction in the technology-enhanced physical education program incorporating freestyle wrestling techniques, whereas the control group is taught in a traditional elementary school program.

Instruction

The essential reasons for introducing classes that include freestyle wrestling methods are: (1) the interest shown by students in freestyle wrestling classes; (2) the appropriate level of training and specialization of physical education teachers; and (3) low material costs (for primary schools and students) in terms of organizing freestyle wrestling classes. The experimental part of the program was based on increasing the number of hours for the "freestyle wrestling" section due to the expanded use of freestyle wrestling techniques. In this regard, the following tasks were set: (1) to clarify the volume of educational material required to be mastered in the fourth grades of the State Educational Standard in Physical Education; (2) to determine the place of educational material in the curriculum for fourth grades; (3) to determine the content of the main sections of educational material based on the State Educational Standard: a) theoretical block; b) practical block (outdoor games, freestyle wrestling, track, and field); (4) to determine the required amount of time for the "freestyle wrestling" section in the curriculum for fourth-grade students; (5) to justify the assessment of the level of preparedness of fourth-grade students in physical education with the expanded use of freestyle wrestling techniques.

The content of the program, as well as the means, methods, and forms of organizing classes used, represent the author's developed methodology for developing physical activity, involvement, and motivation of students based on freestyle wrestling classes in the conditions of regulated classes in primary school. The content of the program is built in two directions: classes in the conditions of regulated classes in primary school; and tasks offered as homework. The first direction is generally represented by a wide range of physical exercises (general developmental, general preparatory, and special preparatory), familiarization with which begins in the experimental group and continues throughout the entire period of the study (see Figure 1).

Figure 1. A variety of physical exercises



The structure of freestyle wrestling classes within a lesson is presented in the following sections:

1. Theoretical training—up to 15% of the total lesson time;

2. Teaching the basics of technical and tactical actions—40-45% of the total lesson time;

3. Special and general physical training: 35-40% of the total lesson time;

4. Psychological training—up to 10% of the total lesson time.

The content of theoretical training includes: the formation of knowledge about the sport, its place and importance in the system of physical education, competition rules, content and organization of freestyle wrestling classes; teaching independent physical exercises and formation of an attitude towards one's self-improvement; teaching the principles of self-control and control over physical activity during classes; mastering such types of physical exercises that could be used throughout life (taking into account the interests of students). Theoretical training is conducted as an element of practical classes directly during the freestyle wrestling lesson. This allowed theoretical knowledge to be organically linked with physical, technical, tactical, and psychological training. It had a certain target orientation—the formation of the student's ability to use the acquired knowledge in practice in the conditions of independent classes.

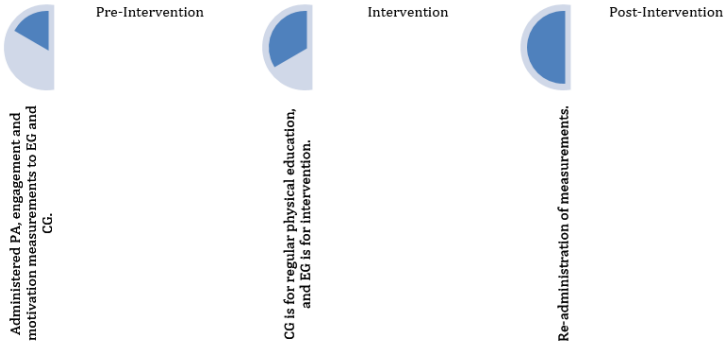
The content of technical and tactical training includes: the formation of the basics of conducting martial arts: basic positions in wrestling (positions at the beginning and end of the fight, forms of greeting; types of stance, parterre, distance; elements of maneuvering in a stance, on the parterre; protection from leg grabs); mastering the elements of technique and tactics of a type of wrestling: wrestling technique in a stance; wrestling technique on the parterre; the simplest methods of tactical training for carrying out techniques (shackles, maneuvers, loss of balance, etc.) are studied simultaneously with mastering technical techniques; games with elements of martial arts (touch games, crowding games; opening games, tug-of-war games, attacking and blocking grabs games, balance maintenance games).

The content of psychological training is aimed at instilling a sustainable interest in physical exercise; forming an attitude towards training activities; forming moral and volitional qualities of the students' personalities; developing and improving the emotional and communicative qualities of the personality; and developing and improving the students' intelligence. This is achieved through the use of conversation methods, persuasion, pedagogical suggestions, and methods of modeling a competitive situation through play.

Intervention Implementation

Figure 2 shows the procedural steps, which include baseline measurements, intervention implementation for both EG and CG, and post-intervention measurements.

Figure 2. Procedure for intervention implementation



Instruments: Student activity, engagement and motivation questionnaire (SAEM-Q)

This survey is intended to record several aspects (Appendix A):

Physical Activity (Section 1) assesses how often students engage in movement during different parts of the day. Engagement (Section 2) measures students' interest and active participation during the classes, particularly in activities like freestyle wrestling and the use of technology. Motivation (Section 3) evaluates the students' drive and enthusiasm for physical activity. For some questions, participants use the "frequency scale" (1 = never, 2 = rarely, 3 = sometimes, 4 = often). 5 = Always) and for others, use the "agreement scale."(1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree).

Data Analysis

Descriptive statistics were used to summarize participant demographics and baseline physical activity, engagement, and motivation data (means, standard deviations, and frequencies). Paired t-tests compared pre-test and post-test physical activity, engagement, and motivation levels within each group. For gender differences in the post-test (EG), independent samples t-tests were employed. Effect size calculations were used to determine the practical significance of the intervention. SPSS 26 was used for data analysis.

Results

Table 2 displays the findings of descriptive statistics for baseline SAEM-Q scores.

Table 2. Descriptive statistics of participant baseline SAEM-Q Scores.

Variable	EG (n = 52)	CG (n = 56)
Baseline SAEM-Q Physical Activity Score, mean ± SD	3.1 ± 0.5	3.0 ± 0.6
Baseline SAEM-Q Engagement Score, mean ± SD	3.3 ± 0.6	3.2 ± 0.5
Baseline SAEM-Q Motivation Score, mean ± SD	3.4 ± 0.5	3.3 ± 0.6

Source: Own creation.

The outcomes clearly show how the EG and CG begin at almost the same level in physical activity, engagement, and motivation, as evidenced by the small variations in SAEM-Q scores for these domains. This baseline equivalency is important because it suggests that any notable changes that occur following the intervention are more likely to be due to the freestyle wrestling techniques used in the technology-enhanced physical education program than the differences between the groups.

Table 3 presents paired t-test results comparing pre-test and post-test SAEM-Q scores for physical activity, engagement, and motivation within the EG and CG.

Table 3. Pre-test and post-test SAEM-Q score results

Variable	Group	Pre-Test Mean ± SD	Post-Test Mean ± SD	Mean Difference	t-value	df	p-value
Physical activity	EG	3.1 ± 0.5	3.7 ± 0.4	0.6	4.32	51	<0.001
	CG	3.0 ± 0.6	3.1 ± 0.6	0.1	1.45	55	0.155
Engagement	EG	3.3 ± 0.6	3.7 ± 0.5	0.4	3.95	51	<0.001
	CG	3.2 ± 0.5	3.3 ± 0.5	0.1	0.98	55	0.331
Motivation	EG	3.4 ± 0.5	3.8 ± 0.4	0.4	4.10	51	<0.001
	CG	3.3 ± 0.6	3.4 ± 0.6	0.1	1.20	55	0.235

Source: Own creation.

The paired t-test results reveal significant improvements in the experimental group across all three dimensions of the SAEM-Q—physical activity, engagement, and motivation—following the intervention. These findings suggest that the integrated, technology-enhanced physical education program significantly enhances primary school students' physical activity, engagement, and motivation compared to the conventional physical education curriculum.

The post-test SAEM-Q scores for the EG and CG are compared in Table 4 (while controlling for baseline differences).

Table 4. Results for SAEM-Q post-test scores

Variable	EG Post-Test Mean ± SD	CG Post-Test Mean ± SD	Mean Difference	t-value	df	p-value
Physical Activity	3.7 ± 0.4	3.1 ± 0.6	0.6	3.80	106	<0.001
Engagement	3.7 ± 0.5	3.3 ± 0.5	0.4	3.20	106	0.002
Motivation	3.8 ± 0.4	3.4 ± 0.6	0.4	3.50	106	0.001

Source: Own creation.

Referring to Table 4, all p-values achieved statistical significance ($p < 0.05$). The EG performed better than the CG in terms of engagement, motivation, and physical activity.

The post-test SAEM-Q scores within the EG are compared by gender (male vs. female) in Table 5.

Table 5. Independent samples t-test results for gender differences in post-test SAEM-Q Scores (EG)

Variable	Male (n = 28) Post-Test Mean ± SD	Female (n = 24) Post-Test Mean ± SD	Mean Difference	t-value	df	p-value
Physical Activity	3.80 ± 0.35	3.65 ± 0.40	0.15	2.15	50	0.036
Engagement	3.75 ± 0.45	3.85 ± 0.50	−0.10	−1.10	50	0.275
Motivation	3.90 ± 0.40	3.70 ± 0.45	0.20	2.00	50	0.049

Source: Own creation.

A positive value indicates that male participants scored higher than female participants on that variable. For physical activity, the male group scored significantly higher than the female group (mean difference = 0.15, $p = 0.036$). For engagement, there was no significant difference between males and females ($p = 0.275$). For motivation, males also scored significantly higher than females (mean difference = 0.20, $p = 0.049$). These results suggest that gender may influence certain aspects of the program's effectiveness, particularly in enhancing physical activity and motivation. However, engagement levels did not differ significantly between male and female students.

Table 6 shows effect size (Cohen's d) calculations that determine the practical significance of the intervention for both within-group (pre-post changes in the EG) and between-group (post-test differences) comparisons.

Table 6. Effect Size (Cohen's d) calculations for the intervention

Variable	Within Experimental Group (Pre-Post) d	Between-Group (Post-Test) d
Physical Activity	1.32	1.18
Engagement	0.72	0.80
Motivation	0.88	0.78

Source: Own creation.

Referring to Table 6, to Cohen's conventions, d values of 0.2 are considered small, 0.5 moderate, and 0.8 or above large. These effect sizes indicate a large practical impact on physical activity and moderate-to-large effects on engagement and motivation.

Discussion

The study assessed a technology-enhanced physical education program incorporating freestyle wrestling techniques to improve elementary school students' physical activity, engagement and motivation. This was the first study to look at the connection between a technology-enhanced program that included freestyle wrestling techniques and the perceived physical activity, engagement, and motivation of Kazakhstani elementary school students during physical education. This study found that the baseline scores for the SAEM-Q revealed that both groups started with similar levels of physical activity, engagement, and motivation. This created a solid basis for directly linking the intervention to changes in motivation, engagement, and physical activity after the intervention. The findings indicated that after the intervention, the experimental group (EG) showed a significant increase in physical activity levels (mean increase = 0.6, $t(51) = 4.32$, $p < 0.001$), whereas the CG did not show a significant change (mean increase = 0.1, $t(55) = 1.45$, $p = 0.155$). Engagement scores in the EG improved significantly (mean increase = 0.4, $t(51) = 3.95$, $p < 0.001$). In contrast, the control group (CG) exhibited minimal change (mean increase = 0.1, $t(55) = 0.98$, $p = 0.331$). The EG demonstrated a statistically significant enhancement in motivation (mean increase = 0.4, $t(51) = 4.10$, $p < 0.001$) compared to the CG, which showed a non-significant change (mean increase = 0.1, $t(55) = 1.20$, $p = 0.235$). These findings suggest that, in comparison to traditional physical education, the technology-enhanced program that incorporated freestyle wrestling techniques significantly improved the physical activity, engagement and motivation of elementary school pupils. These findings align with existing results from other studies on this issue (Melki & Bouzid, 2023; Krishnan et al., 2024; Ulupınar et al., 2021).

Significant differences between boys and girls were found, indicating that gender plays a critical role in a student's physical education (Cárcamo et al., 2021; Benítez-Sillero et al., 2025). Male students achieved significantly higher physical activity scores (3.80 ± 0.35) compared to female students (3.65 ± 0.40). This indicates that the intervention may have been more effective in increasing physical activity levels among boys. Although female students recorded a slightly higher engagement mean (3.85 ± 0.50) than male students (3.75 ± 0.45), the difference was not statistically significant ($t(50) = -1.10$, $p = 0.275$). This suggests that the technology-enhanced program similarly influenced student engagement across genders. Male students also showed significantly higher motivation scores (3.90 ± 0.40) relative to female students (3.70 ± 0.45). To summarize, the program has had a more pronounced effect on increasing motivation among boys.

These results highlight that male students tended to exhibit greater improvements in physical activity and motivation compared to their female counterparts. The comparable engagement scores, however, suggest that the program was equally engaging for both genders (Metcalfe & Lindsey, 2020; Galindo Perdomo et al., 2023).

The effect size calculations provide valuable insight into the practical significance of the intervention and complement the statistically significant findings by demonstrating that the improvements observed in physical activity, engagement, and motivation are not only reliable but also meaningful in practical terms. The substantial effect sizes, particularly for physical activity, affirm the efficacy of the integrated, technology-enhanced approach, thereby supporting its potential for broader application in primary school physical education curricula.

Research indicates that using a range of technologies and freestyle wrestling techniques is the most obvious and successful way to improve physical education for elementary school students (Chen et al., 2018; Hollis et al., 2016). According to Yip et al. (2023), elementary school students can exhibit their motivation, engagement, and physical activity through creative training materials to enhance their physical capabilities and, most importantly, their health. Aubert et al. (2022), Cheung (2019) and de Jesus et al. (2022) claim that incorporating technology into physical education curricula in elementary schools enables teachers to plan their students' physical activity.

Therefore, it has been shown that the development of students' physical activity, engagement, and motivation is greatly influenced by the possibility of an effective technology-enhanced physical education program that integrates freestyle wrestling techniques. In summary, students who use technology that integrates freestyle wrestling techniques and those who receive traditional physical education differ in terms of motivation, engagement, and physical activity. Gender differences also impact the impact of a technology-enhanced physical education program that uses freestyle wrestling techniques on the engagement, motivation, and physical activity of elementary school pupils.

Limitations of the Study

This study's geographic focus on southern Kazakhstan may make it challenging to adequately represent the range of physical education of students in elementary school experiences available across the country. However, a thorough investigation of the degree of physical activity, motivation, and engagement of students in two groups—measured both before and after the intervention—was made possible by the quantitative data. Future studies could take a more comprehensive approach and use qualitative data collection methods to offer insights into elementary school students' levels of physical activity, engagement, and motivation to improve their physical literacy.

Conclusions

To conclude, this study has provided new insight into the relationship between technology incorporating freestyle wrestling techniques and increased physical activity, engagement, and motivation in Kazakhstani students, a critical yet unexplored area in Kazakhstani primary education. By utilizing technology and survey analysis, this study provides a quantitative, evidence-based perspective for curriculum development that combines traditional methods with modern technology, incorporating freestyle wrestling techniques. The results of the study showed that participants of the experimental group, which participated in technology-enhanced physical education sessions incorporating freestyle wrestling, showed a significant increase in physical activity, engagement, and motivation compared to the control group, which exhibited only a marginal, non-significant increase. Consequently, utilizing the suggested methodology had benefits over the traditional program. As a result, the experiment's expanded use of free-style wrestling techniques greatly improved the educational process' efficacy and enabled younger students to develop their physical activity, motivation, and engagement while also successfully forming the skills and abilities required of fourth graders and raising their level of physical quality development. This study contributes to the discourse on physical education development in elementary schools in Kazakhstan by underscoring its importance for the improvement of the established methodology for managing the process of PE of schoolchildren.

Acknowledgements

The authors would like to thank to all the participants who took part in our research.

References

Almusawi, H. A., Durugbo, C. M., & Bugawa, A. M. (2021). Innovation in physical education: Teachers' perspectives on readiness for wearable technology integration. Computers & Education, 167, 104185. https://doi.org/10.1016/j.compedu.2021.104185

Aubert, S., Barnes, J. D., Demchenko, I., Hawthorne, M., Abdeta, C., Abi Nader, P., ... & Tremblay, M. S. (2022). Global matrix 4.0 physical activity report card grades for children and adolescents: results and analyses from 57 countries. Journal of Physical Activity and Health, 19(11), 700-728. https://doi.org/10.1123/jpah.2022-0456

Braga, L., Jones, E., Bulger, S., & Elliott, E. (2017). Empowering teachers to implement innovative content in physical education through continuous professional development. Teacher Development, 21(2), 288-306. https://doi.org/10.1080/13664530.2016.1235608

Bermejo-Cantarero, A., Álvarez-Bueno, C., Martínez-Vizcaino, V., Redondo-Tébar, A., Pozuelo-Carrascosa, D. P., & Sánchez-López, M. (2021). Relationship between both cardiorespiratory and

muscular fitness and health-related quality of life in children and adolescents: A systematic review and meta-analysis of observational studies. Health and quality of life outcomes, 19, 1-15. https://doi.org/10.1186/s12955-021-01766-0

Benítez-Sillero, J. de D., Castejón-Riber, C., Portela-Pino, I., & Raya-González, J. (2025). Influencia del tipo de deporte practicado por los adolescentes españoles en su autoconcepto, autoestima y condición física. Retos, 66, 361–373. https://doi.org/10.47197/retos.v66.111569

Botagariyev, T., Mambetov, N., Aralbayev, A., Mukhanbetaliyev, A., Ispulova, R., & Akhmetov, N. (2024). Tecnologías basadas en la web en la educación física de la escuela secundaria (Web-Based Technologies in Middle School Physical Education). Retos, 51, 172–178. https://doi.org/10.47197/retos.v51.100310

Cárcamo, C., Moreno, A., & Del Barrio, C. (2021). Girls do not sweat: the development of gender stereotypes in physical education in primary school. Human Arenas, 4(2), 196-217. https://doi.org/10.1007/s42087-020-00118-6

Chen, Z., Chi, G., Wang, L., Chen, S., Yan, J., & Li, S. (2022). The combinations of physical activity, screen time, and sleep, and their associations with self-reported physical fitness in children and adolescents. International journal of environmental research and public health, 19(10), 5783. https://doi.org/10.3390/ijerph19105783

Chen, H. J., Liao, L. L., Chang, Y. C., Hung, C. C., & Chang, L. C. (2019). Factors Influencing Technology Integration in the Curriculum for Taiwanese Health Profession Educators: A Mixed-Methods Study. International journal of environmental research and public health, 16(14), 2602. https://doi.org/10.3390/ijerph16142602

Chen, W., Hammond-Bennett, A., Hypnar, A., & Mason, S. (2018). Health-related physical fitness and physical activity in elementary school students. BMC public health, 18, 1-12. https://doi.org/10.1186/s12889-018-5107-4

Cheung, P. (2019). School-based physical activity opportunities in PE lessons and after-school hours: Are they associated with children's daily physical activity? European Physical Education Review, 25(1), 65-75. https://doi.org/10.1177/1356336X17705274

Deng, C., Feng, L., & Ye, Q. (2024). Smart physical education: governance of school physical education in the era of new generation of information technology and knowledge. Journal of the Knowledge Economy, 15(3), 13857-13889. https://doi.org/10.1007/s13132-023-01668-0

de Jesus, G. M., de Oliveira Araujo, R. H., Dias, L. A., Barros, A. K. C., dos Santos Araujo, L. D. M., & de Assis, M. A. A. (2022). Attendance in physical education classes, sedentary behavior, and different forms of physical activity among schoolchildren: a cross-sectional study. BMC public health, 22(1), 1461. https://doi.org/10.1186/s12889-022-13864-9

Gao, Z., & Lee, J. E. (2019). Emerging technology in promoting physical activity and health: challenges and opportunities. Journal of clinical medicine, 8(11), 1830. https://doi.org/10.3390/jcm8111830

Galindo Perdomo, F., Camacho Coy, H. ., & Monterrosa Quintero , A. . (2023). Asociación entre niveles de actividad física autopercibida y variables sociodemográficas en escolares (Association between levels of self-perceived physical activity and sociodemographic variables at school-children). Retos, 50, 456–463. https://doi.org/10.47197/retos.v50.99157

García-Rico, L., Martínez-Muñoz, L. F., Santos-Pastor, M. L., & Chiva-Bartoll, O. (2021). Service-learning in physical education teacher education: A pedagogical model towards sustainable development goals. International Journal of Sustainability in Higher Education, 22(4), 747-765. https://doi.org/10.1108/IJSHE-09-2020-0325

Gawrisch, D. P., Richards, K. A. R., & Killian, C. M. (2020). Integrating technology in physical education teacher education: A socialization perspective. Quest, 72(3), 260-277. https://doi.org/10.1080/00336297.2019.1685554

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. Sustainable operations and computers, 3, 275-285. https://doi.org/10.1016/j.susoc.2022.05.004

Hollis, J. L., Williams, A. J., Sutherland, R., Campbell, E., Nathan, N., Wolfenden, L., ... & Wiggers, J. (2016). A systematic review and meta-analysis of moderate-to-vigorous physical activity levels in elementary school physical education lessons. Preventive medicine, 86, 34-54. https://doi.org/10.1016/j.ypmed.2015.11.018

Jones, E. M., Baek, J. H., & Wyant, J. D. (2017). Exploring pre-service physical education teacher technology use during student teaching. Journal of Teaching in Physical Education, 36(2), 173-184. https://doi.org/10.1123/jtpe.2015-0176

Karibaev, Z., Zhumabayeva, A., Kurbonova, B., & Nurgaliyeva, S. (2024). Subjective Well-Being Among Students with Disabilities in Kazakhstan: An Exploratory Study. Journal of Curriculum Studies Research, 6(2), 88-103. https://doi.org/10.46303/jcsr.2024.12

Kequn, C., Xiuqing, Y., & Tinghui, Z. (2025). The impact of physical exercise on primary school teachers' professional ethics: the mediating role of self-control. Frontiers in Psychology, 15, 1532734. https://doi.org/10.3389/fpsyg.2024.1532734

Krause, J. M., O'Neil, K., & Jones, E. (2020). Technology in physical education teacher education: A call to action. Quest, 72(3), 241-259. https://doi.org/10.1080/00336297.2019.1685553

Krishnan, C., Lamba Sahdev, S., & Mariappan, J. (2024). Navigating complexity: thematic insights into ethical challenges and metaverse integration in Indian education institutions. Cogent Education, 11(1), 2428110. https://doi.org/10.1080/2331186X.2024.2428110

Kuralbayeva, A. A., Tasova, A., Sultanbek, M., Jazdykbayeva, M., Kozhageldieva, S., & Shalabaeva, Z. (2025). Evaluación del Impacto de la Pedagogía No Lineal en el Compromiso Estudiantil en Educación Física. Retos, 66, 1041–1056. https://doi.org/10.47197/retos.v66.114393

Melki, H., & Bouzid, M. S. (2023). Teaching wrestling at school: proposal of a new pedagogical approach based on games for learning of technical moves. Pedagogy of Physical Culture and Sports, 27(2), 123-130. https://doi.org/10.15561/26649837.2023.0204

Metcalfe, S. N., & Lindsey, I. (2020). Gendered trends in young people's participation in active lifestyles: The need for a gender-neutral narrative. European Physical Education Review, 26(2), 535-551. https://doi.org/10.1177/1356336X19874095

Nurgaliyeva, S., Bolatov, A., Abildina, S., Zeinolla, S., Kurbonova, B., & Kyyakbayeva, U. (2024). COVID-19 online learning challenges: Kazakhstan secondary schools case study. Frontiers in Education, 9, 1448594. https://doi.org/10.3389/feduc.2024.1448594

Nurgaliyeva, S., Iztleuova, Z., Maigeldiyeva, S., Zhussupova, Z., Saduakas, G., & Omarova, G. (2023). Examining the Relationships between Teachers' Job Satisfaction and Technological Competencies. International Journal of Education in Mathematics, Science and Technology, 11(4), 898-912. https://doi.org/10.46328/ijemst.3375

Ospankulov, Y., Zhumabayeva, A., & Nurgaliyeva, S. (2023). The impact of folk games on primary school students. Journal of Education and E-Learning Research, 10(2), 125–131.Available at: https://doi.org/10.20448/jeelr.v10i2.4473

Phelps, A., Colburn, J., Hodges, M., Knipe, R., Doherty, B., & Keating, X. D. (2021). A qualitative exploration of technology use among preservice physical education teachers in a secondary methods course. Teaching and Teacher Education, 105, 103400. https://doi.org/10.1016/j.tate.2021.103400

Redondo Tébar, A., Lopes, L., Martinez-Vizcaino, V., Gutierrez, D., Hernández-Martínez, A., Sánchez-Matas, Y., & Sanchez-Lopez, M. (2025). Validez y fiabilidad de la batería reducida para la evaluación de la competencia motora (MABC-2) en escolares españoles de 4 a 7 años. Retos, 67, 162–172. https://doi.org/10.47197/retos.v67.110928

Serdyukov, P. (2017). Innovation in education: what works, what doesn't, and what to do about it?. Journal of research in innovative teaching & learning, 10(1), 4-33. https://doi.org/10.1108/JRIT-10-2016-0007

Tajibayeva, Z., Nurgaliyeva, S., Aubakirova, K., Ladzina, N., Shaushekova, B., Yespolova, G., & Taurbekova, A. (2023). Investigation of the psychological, pedagogical and technological adaptation levels of repatriated university students. International Journal of Education in Mathematics, Science, and Technology (IJEMST), 11(3), 755-774. https://doi.org/10.46328/ijemst.3336

Ulupınar, S., Özbay, S., Gençoğlu, C., & İnce, İ. (2021). Performance Differences Between Greco-Roman and Freestyle Wrestlers: A Systematic Review and Meta-Analysis. Journal of strength and conditioning research, 35(11), 3270–3279. https://doi.org/10.1519/JSC.0000000000004129

Wyant, J., & Baek, J. H. (2019). Re-thinking technology adoption in physical education. Curriculum Studies in Health and Physical Education, 10(1), 3-17. https://doi.org/10.1080/25742981.2018.1514983

Wyant, J. D., Keath, A., Towner, B., Wayda, V., & Baek, J. H. (2024). Navigating the TECHNOLGY Integration Landscape in Physical Education: Principles, Tools, and Solutions for Sustained Use. Journal of

Physical Education, Recreation & Dance, 95(9), 29-35. https://doi.org/10.1080/07303084.2024.2396306

Xie, M. (2021). Design of a physical education training system based on an intelligent vision. Computer Applications in Engineering Education, 29(3), 590-602. https://doi.org/10.1002/cae.22259

Xing, Z., & Qi, Y. (2023). Development of creativity in physical education teachers using interactive technologies: involvement and collaboration. Education and information technologies, 28(5), 5763-5777. https://doi.org/10.1007/s10639-022-11422-9

Yip, P. K., Cheng, L., & Cheung, P. (2023). The association of children's motivation and physical activity levels with flipped learning during physical education lessons. European Physical Education Review, 29(4), 601-618. https://doi.org/10.1177/1356336X231170990

Zha, H., Li, W., Wang, W., & Xiao, J. (2025). The Paradox of AI Empowerment in Primary School Physical Education: Why Technology May Hinder, Not Help, Teaching Efficiency. Behavioral Sciences, 15(2), 240. https://doi.org/10.3390/bs15020240

Zheng, W., Shen, H., Belhaidas, M. B., Zhao, Y., Wang, L., & Yan, J. (2023). The relationship between physical fitness and perceived well-being, motivation, and enjoyment in Chinese adolescents during physical education: a preliminary cross-sectional study. Children, 10(1), 111. https://doi.org/10.3390/children10010111

Authors' and translators' details:

Batyrbek Mendigaliyev	mendigaliyev1990@mail.ru	Autor/a
Yernar Ospankulov	ospankulovernar2@gmail.com	Autor/a
Nazerke Kaden	mira@mail.ru	Autor/a
Laura Orynbayeva	laura@mail.ru	Autor/a
Rakhym Bayaliyev	rakhym.bayaliyev@inbox.ru	Autor/a
Aziza Zhunusbekova	aziza.zhunusbekova@inbox.ru	Autor/a
Aizhan Nurgaliyeva	sanianur@mail.ru	Autor/a

Appendix A

Questionnaire (SAEM-Q)

Section 1: Physical Activity

1.During physical education classes, I was very active.

(Frequency: 1 2 3 4 5)

2.During recess, I ran, jumped, and played games.

(Frequency: 1 2 3 4 5)

3.After school, I participated in sports or active play.

(Frequency: 1 2 3 4 5)

4.On weekends, I engaged in physical activities like games or sports.

(Frequency: 1 2 3 4 5)

Section 2: Engagement in Physical Education

5.I enjoyed the activities in our PE class, especially freestyle wrestling.

(Agreement: 1 2 3 4 5)

6.I paid close attention during PE class and was excited to learn new skills.

(Agreement: 1 2 3 4 5)

7.Using technology in PE (videos, apps, digital feedback) made the class more interesting.

(Agreement: 1 2 3 4 5)

8.I looked forward to coming to PE class.

(Agreement: 1 2 3 4 5)

Section 3: Motivation

9.I try my best in PE class because I enjoy being active.

(Agreement: 1 2 3 4 5)

10.I feel proud when I learn new physical skills during class.

(Agreement: 1 2 3 4 5)

11.I want to get better at sports and games.

(Agreement: 1 2 3 4 5)

12.Even when activities are challenging, I stay motivated to participate.

(Agreement: 1 2 3 4 5)

Optional Section (Open-Ended):

13. What is your favorite part of PE class and why?

(Students can write a short answer or share verbally.)