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MOTIVATIONAL PROFILES AND PHYSICAL ACTIVITY OF UNIVERSITY STUDENTS: ASSOCIATIONS WITH LEARNING FORMAT AND SOCIAL SUPPORT

Abstract. The relevance of this study is determined by the need to understand how motivational regulation and university learning conditions are associated with students' regular physical activity. The aim was to identify motivational profiles and examine their associations with physical activity, learning format, and social support. The quantitative observational study included 250 first- and second-year students (185 men and 65 women; 17–20 years) enrolled in the 6B07102 Electric Power Engineering program at S. Seifullin Kazakh Agrotechnical Research University. A 12-item author-developed questionnaire informed by self-determination theory assessed autonomous regulation, controlled regulation, social support, and subjective appraisal of physical activity. The archived analysis distinguished three descriptive motivational profiles. Weekly physical activity differed substantially across the profiles, $F(2, 247) = 149.17$, $p < .001$, $\eta^2 = .547$: autonomous-profile students reported 4.60 ± 1.20 active days per week, controlled-profile students 3.20 ± 1.00 , and low-motivation students 1.40 ± 0.70 . Social support was positively correlated with physical activity ($r = .35-.48$, $p < .001$). Descriptive differences were also observed across learning formats. The findings identify associations rather than causal effects and support motivation-sensitive and socially supportive approaches to physical education in higher education.

Key words: university students, physical activity, motivational profiles, self-determination theory, social support, learning format.

Introduction

In contemporary research at the intersection of education and health, students' physical activity is increasingly conceptualized as a key determinant of human capital formation, academic achievement, and a sustainable lifestyle in the long term. Amid the transformation of the university educational environment driven by digitalization, the expansion of hybrid learning formats, and shifts in patterns of social interaction the challenge of maintaining and developing systematic physical activity among learners has become distinctly interdisciplinary, extending beyond the boundaries of traditional physical education.

In the scholarly literature, students' physical activity is progressively examined through the lens of motivational frameworks, most notably self-determination theory, which posits that the stability of behavioral practices is associated with the predominance of autonomous rather than controlled motivation (Ryan & Deci, 2000). Empirical evidence and systematic reviews further indicate that intrinsic motivation and the satisfaction of basic psychological needs autonomy, competence, and relatedness serve as robust predictors of regular physical activity in student populations (Teixeira et al., 2012; Ntoumanis et al., 2021). At the same time, the educational environment is emphasized as a contextual factor that can either support or constrain students' motivational resources.

In recent years, increasing attention has been devoted to the transformation of the university educational environment as an integrated set of spatial, organizational, digital, and social-communicative conditions shaping students' behaviors and attitudes. Studies addressing changes in lifestyle and interaction patterns during periods of intensified digitalization and pandemic-related restrictions point to an ambivalent effect: on the one hand, flexibility and personalization of the educational process are strengthened; on the other, the risks of insufficient physical activity and increased sedentary behavior rise, potentially accompanied by weakened everyday social ties (Guthold et al., 2020; Hall et al., 2021). Accordingly, the purposeful design of an educational environment oriented not only toward academic outcomes but also toward the maintenance of students' physical activity and well-being becomes increasingly critical.

For the higher education system of the Republic of Kazakhstan, the relevance of this issue is further

amplified by institutional transformations, the implementation of digital educational platforms, and a reconsideration of universities' roles in fostering a healthy and socially active generation. Despite the existence of individual studies on the physical activity of university youth, the field still lacks a sufficiently systematized analysis of the relationships among students' motivational characteristics, features of the transformed educational environment, and social factors, including team dynamics and forms of support. This gap necessitates a comprehensive study integrating motivational, environmental, and social parameters.

The aim of this study was to identify students' motivational profiles and examine their associations with physical activity, learning format, and social support in the university context.

To achieve this aim, the study addressed the following objectives:

- to critically compare theoretical and empirical approaches to motivation for university students' physical activity;
- to describe physical-activity indicators across face-to-face, hybrid, and distance learning formats;
- to characterize students' motivational profiles and compare their weekly physical activity;
- to examine the associations of social support and team-based participation with physical activity;
- to interpret the findings as observational associations and identify implications for university physical-education practice.

The theoretical significance of the study lies in integrating self-determination theory with learning-context and social-support indicators within one university sample. Its practical significance lies in identifying motivational and social patterns that may inform the design of physical-education and student-support practices without treating observational associations as causal effects.

Literature review

Self-determination theory (SDT) provides the main framework for interpreting physical-activity motivation as a continuum from controlled to autonomous regulation. Across exercise and health research, autonomous regulation and satisfaction of basic psychological needs are consistently associated with more persistent activity patterns, whereas externally controlled regulation is less stable (Ryan & Deci, 2000; Teixeira et al., 2012; Ntoumanis et al., 2021; Ntoumanis & Moller, 2025). A recent narrative review similarly emphasizes internalized goals and autonomy as central to sustained fitness behavior (Gao et al., 2024).

University studies nevertheless differ substantially in instruments and outcomes. Sáez et al. (2021) linked motivational regulation, sport satisfaction, and activity in students, while Durán-Vinagre et al. (2023) examined BREQ-3-based motivational processes and intention to remain active. Vučković et al. (2022) combined exercise-motive and physical-activity measures in a post-lockdown student sample, and Yu et al. (2024) examined motivation, leisure satisfaction, mental toughness, and self-efficacy. These studies support the relevance of motivational regulation but also illustrate the dominance of cross-sectional self-report designs.

Social and environmental context adds another layer. Social support is associated with physical activity in university populations (Huang et al., 2025; Wang et al., 2024), while campus infrastructure and built-environment characteristics correlate with student health and fitness indicators (Ding et al., 2024; Lu et al., 2022). Broader evidence also shows the challenge of insufficient activity and sedentary behavior among young people and during periods of disrupted routines (Guthold et al., 2020; Hall et al., 2021).

Digital tools can support monitoring and engagement, but their effects depend on design and context. Wearable-tracker and mHealth studies report heterogeneous results across motivational interviewing, gamification, and community-support models (Nuss et al., 2023; Sañudo et al., 2024; Ash et al., 2025). Technology-supported physical-education designs also emphasize the importance of integrating digital tools with pedagogical structure rather than treating technology as an independent intervention (Sultoni et al., 2022).

In Kazakhstan, research on digital culture and technology-supported learning has highlighted changes in student engagement and the motivational potential of immersive tools (Tleshova & Gerfanova, 2024; Kussainova et al., 2025). Learning motivation has also been discussed as an indicator and condition of psychological well-being (Abildina et al., 2025). At the institutional level, the Health Promoting University framework integrates policy, infrastructure, programs, and participation, but implementation patterns remain context-dependent (Tafireyi & Grace, 2024; Comellas-Sáenz et al., 2025).

Prior studies therefore provide strong evidence for the relevance of autonomous motivation, social support, and environmental context, but they differ in design, measurement, and population. To clarify what

can and cannot be inferred across this literature, Table 1 summarizes representative studies that directly inform the present design.

Table 1

Selected empirical evidence relevant to motivational profiles, social support, learning context, and physical activity

Study / country-sample	Design & instruments	Digital tools	Statistics	Main finding	Limitation relevant here
Sáez et al., 2021 / Spain, n=1,099 students	Cross-sectional; short BREQ-2, PA hours, sport satisfaction	No	Correlations, t tests, CFA	Intrinsic regulation related to greater PA and satisfaction	Self-report; cross-sectional; two universities
Durán-Vinagre et al., 2023 / Spain, n=1,524 students	Cross-sectional; BREQ-3 and MIFAU	No	CFA, correlations, group comparisons	Self-determined regulation associated with intention to remain active	Cross-sectional; intention rather than objective PA
Nuss et al., 2023 / USA, n=40 inactive adults	12-week RCT; motivation and PA	Wearable tracker	Between-condition comparisons	Wearable effects depended on intervention combination	Small non-student sample
Sañudo et al., 2024 / Spain, 105 allocated young adults	8-week randomized mHealth trial; accelerometry and IPAQ	App + activity trackers	RCT group comparisons	Gamified mHealth improved selected PA outcomes	Young adults; attrition
Ash et al., 2025 / USA, 335 analytic	Retrospective longitudinal program analysis	MoveSpring + tracker/pedometer	χ^2 , survival/regression	Engagement and social features associated with retention/goals	Single university; mixed students/staff
Huang et al., 2025 / n=1,530 university students	Survey/path analysis; support, empowerment, exercise behavior	Not central	Path/mediation models	Support and empowerment associated with behavior-change processes	Context-specific; causal caution
Lu et al., 2022 / China, 4 colleges, n=1,498	Cross-sectional GIS + fitness records	GIS	Correlations	Built environment correlated with fitness outcomes	Fitness $\neq$ motivation; cross-sectional

The comparison shows three recurring limitations in the available evidence: heavy reliance on cross-sectional self-report designs, limited integration of motivational and contextual variables within the same university sample, and heterogeneous use of digital measures. The present study therefore focuses on descriptive and associational patterns in a Kazakhstani higher-education context and avoids causal claims that require longitudinal or experimental evidence.

Materials and research methods

The study was conducted at S. Seifullin Kazakh Agrotechnical Research University in Astana, Kazakhstan. The final analytical sample comprised 250 first- and second-year undergraduate students (185 men and 65 women) aged 17–20 years from the Institute of Energy, area of training 6B071 Engineering and Engineering Trades, educational program 6B07102 Electric Power Engineering. The sampled cohorts covered semesters 1–4. The physical-education component considered in the study was delivered over two semesters, with one scheduled class per week. Both first- and second-year students were represented; year-specific counts were not retained in the archived summary dataset.

Participants were recruited during regular university physical-education activities. Inclusion criteria were enrollment in the specified program and study years, participation in regular physical-education classes, and completion of the study questionnaire. Students with a formal medical exemption from practical physical education, an individualized or special study arrangement that prevented participation in regular classes, or incomplete study data were excluded before the final analysis. All 250 eligible students who were invited to

the final study sample participated; no refusals were recorded. The exact number excluded before invitation because of medical or special-study status was not retained. Participation was voluntary and anonymous.

A quantitative observational design was used to examine associations among motivational regulation, learning context, social support, and physical activity. The core study instrument was a 12-item author-developed questionnaire informed by self-determination theory and previous university physical-activity research. It comprised four blocks: autonomous regulation (4 items), controlled regulation (3 items), social support (3 items), and subjective appraisal of physical activity (2 items). All items were rated on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).

The autonomous-regulation items were: “I engage in physical activity because I enjoy it”; “Physical activity is a personal value for me”; “I view physical activity as a way of taking care of myself”; and “I feel an inner need to be physically active.” The controlled-regulation items were: “I engage in physical activity because teachers or people around me expect it”; “I engage in physical activity to avoid negative consequences (e.g., criticism or poor grades)”; and “Physical activity feels more like an obligation than a personal choice.”

The social-support items were: “My friends support me in being physically active”; “Teachers encourage me to be physically active”; and “It is easier for me to be physically active in a group or team.” The subjective-appraisal items were: “I am satisfied with my current level of physical activity” and “I believe physical activity positively affects my well-being and academic performance.” The questionnaire was conceptually informed by studies using established exercise-motivation instruments, including BREQ-2/BREQ-3, but the present 12-item form was not treated as a verbatim reproduction of a standardized scale.

Current-sample internal-consistency coefficients could not be recalculated from the archived aggregate dataset; therefore, no Cronbach’s alpha or McDonald’s omega values are retroactively reported. This limitation is stated explicitly below. The original analysis retained three descriptive motivational-profile categories (autonomous, controlled, and low motivation) based on the archived composite-score classifications. Because the participant-level file used to construct these categories was unavailable for the present revision, the manuscript no longer describes them as statistically validated or stable clusters and does not attribute an unverified Ward or k-means procedure to the original analysis.

Physical activity was summarized using the mean number of active days per week, and the archived summary also contained mean daily activity-time indicators for face-to-face, hybrid, and distance learning contexts. The original manuscript referred to consumer wearables and mobile applications, but device-level metadata, participant coverage, synchronization procedures, and missing-data logs were not retained. Accordingly, digital-device records are not treated as an independent empirical measure in the revised analysis; digital tools are discussed only as contextual evidence from prior research.

For the revised analysis, inferential statistics that could be reconstructed from reported aggregate values were calculated transparently. Differences in active days across the three motivational profiles were assessed with one-way ANOVA, η^2 , Bonferroni-adjusted pairwise comparisons, Cohen’s *d*, and confidence intervals. Pearson correlations between social-support indicators and physical activity were accompanied by 95% confidence intervals, *t* tests, and r^2 . Learning-format values are presented descriptively because the archived summary did not preserve format-specific sample sizes or whether observations were independent or repeated; inferential *p*-values and effect sizes are therefore not reported for that table.

Data collection and interpretation were organized in three stages. First, the diagnostic stage collected questionnaire responses and physical-activity indicators. Second, the analytical stage summarized motivational-profile categories, compared weekly activity across profiles, described activity indicators across learning formats, and examined correlations with social support. Third, the interpretive stage contextualized statistically observed associations; no causal effect of learning format, digital tools, or social support was inferred.

The study is therefore interpreted as a single-sample quantitative observational analysis rather than a mixed-methods or intervention study.

All statistical tests are two-sided. Exact *p*-values are reported where available; otherwise $p < .001$ is used. English decimal points are used consistently throughout the revised manuscript.

The analytic emphasis is on effect size, uncertainty, and association rather than on causal language.

Results and discussion

The revised results focus on the measures that have a visible analytical trace in the archived dataset: motivational-profile categories, weekly physical activity, descriptive learning-format indicators, and social-support correlations. Unsupported references to a separate qualitative strand, a standalone SDT scale, and independent digital-device effects have been removed.

The profile and social-support analyses are inferential where the necessary aggregate values are available. Learning-format statistics are presented descriptively because group-specific denominators and the exact repeated-versus-independent observation structure were not preserved.

1. Students' motivational profiles

The archived analysis classified students into three descriptive motivational profiles: autonomous motivation ($n = 95$; 38%), controlled motivation ($n = 110$; 44%), and low motivation ($n = 45$; 18%). These labels are retained as descriptive profile categories rather than statistically validated clusters. Weekly physical activity differed substantially across the three groups (Table 2).

Table 2

Motivational profiles and weekly physical activity ($N = 250$)

Motivational profile	n	%	Active days/week, M (SD)	95% CI for M
Autonomous motivation	95	38%	4.60 (1.20)	[4.36, 4.84]
Controlled motivation	110	44%	3.20 (1.00)	[3.01, 3.39]
Low motivation	45	18%	1.40 (0.70)	[1.19, 1.61]

One-way ANOVA based on the reported group sizes, means, and standard deviations showed a large between-profile difference, $F(2, 247) = 149.17$, $p < .001$, $\eta^2 = .547$. Bonferroni-adjusted pairwise comparisons were significant for all pairs: autonomous vs controlled, $\Delta M = 1.40$, Cohen's $d = 1.28$, familywise 95% CI [1.05, 1.75], $p < .001$; autonomous vs low motivation, $\Delta M = 3.20$, $d = 3.00$, 95% CI [2.75, 3.65], $p < .001$; and controlled vs low motivation, $\Delta M = 1.80$, $d = 1.95$, 95% CI [1.36, 2.24], $p < .001$. These differences describe the observed sample and do not establish a causal effect of motivational regulation.

2. Physical activity across learning formats

The archived summary contained physical-activity indicators for face-to-face, hybrid, and distance learning contexts. Because format-specific sample sizes and the observation structure were not retained, these values are reported descriptively rather than as an inferential comparison (Table 3).

Table 3

Descriptive physical-activity indicators by learning format

Learning format	Active days/week, M (SD)	Activity time, min/day, M (SD)
Face-to-face	3.80 (1.10)	52 (15)
Hybrid	3.50 (1.00)	49 (14)
Distance	2.60 (0.90)	37 (12)

Mean activity was higher in the face-to-face and hybrid contexts than in the distance context. However, the revised manuscript does not describe these differences as statistically significant because the archived summary does not support a valid reconstruction of the required group-specific inferential test. The values should therefore be interpreted as descriptive patterns only.

3. Social support and team-based participation

Pearson correlations were used to examine the association between social-support indicators and physical activity. The analysis covered support from friends, support from teachers, and participation in team-based activities. All three associations were positive (Table 4).

Table 4*Associations between social support and physical activity (N = 250)*

Indicator	r	95% CI	t(248)	p	r ²
Support from friends	.42	[.31, .52]	7.29	< .001	.176
Support from teacher	.35	[.24, .45]	5.88	< .001	.123
Team participation	.48	[.38, .57]	8.62	< .001	.230

The strongest association was observed for participation in team-based activities ($r = .48$), followed by support from friends ($r = .42$) and support from teachers ($r = .35$). The confidence intervals exclude zero, and all three tests were statistically significant at $p < .001$. Pearson's r and r^2 quantify association strength; p -values indicate evidence against the null hypothesis of zero correlation and should not be interpreted as measures of reliability or causality.

These findings are consistent with evidence that social support and empowerment are associated with university students' physical activity (Huang et al., 2025; Wang et al., 2024). The present results nevertheless remain correlational and do not show that social support independently causes higher activity.

Discussion

The main pattern is the substantial difference in weekly activity across the three motivational-profile categories. Students in the autonomous profile reported the highest activity, which is consistent with SDT-based evidence linking more self-determined regulation to persistent physical activity (Durán-Vinagre et al., 2023; Gao et al., 2024). Controlled motivation was associated with intermediate activity, while the low-motivation profile showed the lowest mean.

Learning-format values showed a descriptive gradient, with higher mean activity in face-to-face and hybrid contexts than in the distance context. Because the archived summary does not preserve the denominators required for a valid between-format test, this pattern is interpreted cautiously and is not presented as evidence that a learning format caused the observed differences.

Social support and team participation showed moderate positive correlations with physical activity. This is compatible with prior evidence emphasizing social interaction and support as motivational resources, but the observational design does not establish temporal direction or rule out confounding (Huang et al., 2025; Wang et al., 2024).

The digital literature provides useful context rather than an independent empirical finding in this study. Wearables, mHealth, and gamification can support activity monitoring and engagement, but effects vary by intervention design, social context, and participant group (Nuss et al., 2023; Sañudo et al., 2024; Ash et al., 2025). The revised manuscript therefore does not claim that digital tools strengthened motivation in the present sample.

In practical terms, the results support attention to autonomy-supportive teaching, team-based participation, and context-sensitive organization of physical education. These implications should be treated as targets for future intervention testing rather than as effects already demonstrated by the present observational data.

The single-university context is also important. Rather than generalizing to all Kazakhstani universities, the findings provide a focused description of first- and second-year engineering students within one institutional environment.

This interpretation is consistent with the Health Promoting University perspective, which treats student activity as embedded in institutional policy, infrastructure, and participation rather than as an individual motivational issue alone (Tafireyi & Grace, 2024; Comellas-Sáenz et al., 2025).

Overall, the evidence is strongest for between-profile differences in weekly activity and for positive associations between social support and activity. The learning-format pattern is descriptive, and no independent digital-tool effect is claimed.

The revised interpretation therefore emphasizes effect sizes, confidence intervals, and limits of inference

rather than causal wording. This aligns the conclusions with the actual observational structure of the study.

The convergence of motivational-profile differences and social-support correlations provides a coherent descriptive pattern, but psychometric and classification uncertainty must be considered because the archived aggregate dataset does not permit recalculation of internal-consistency or profile-stability statistics.

The results are broadly consistent with international studies of motivation, social support, and university physical activity, while the present contribution is the integration of these dimensions in a Kazakhstan-based engineering-student sample.

The findings have practical relevance for:

- physical-education instructors, by supporting the use of autonomy-supportive and team-based practices;
- university administrators, by highlighting the need to consider social support and learning context when planning student-activity initiatives;
- future research and program evaluation, by identifying motivational-profile and social-support indicators that can be tested in longitudinal or controlled designs.

These applications are recommendations for program design and evaluation; they should not be interpreted as causal effects demonstrated in the current dataset.

Limitations

This study has several limitations. First, recruitment was voluntary and non-probability based within a single university, so selection bias cannot be excluded and the findings should not be interpreted as representative of all university students in Kazakhstan. Detailed year-specific counts and the number excluded before invitation were not retained in the archived summary.

Second, the observational design does not establish temporal or causal relationships among motivational profile, learning format, social support, and physical activity. Academic workload, sex/gender, previous sport experience, baseline fitness, and access to sports infrastructure were not comprehensively controlled, and between-university variation could not be evaluated because the sample came from one institution.

Third, part of the evidence relies on self-report. Current-sample internal-consistency coefficients for the author-developed questionnaire could not be recalculated from the archived aggregate dataset, which limits psychometric interpretation of the block scores.

Fourth, device-level metadata for the digital records mentioned in the original manuscript were not available; consequently, the revised analysis does not treat heterogeneous consumer wearables or mobile applications as an independent empirical measure. Learning-format statistics are also descriptive because format-specific sample sizes and the observation structure were not preserved.

Finally, the motivational profiles are retained as descriptive categories from the archived analysis, not as statistically validated clusters. Future studies should retain participant-level data, use validated motivation instruments alongside transparent profile-classification or clustering procedures, standardize activity measurement, and apply longitudinal or controlled designs with multivariable adjustment.

These limitations define the scope of inference and provide a concrete agenda for replication and extension.

Conclusion

This study identified a coherent pattern linking motivational profile, social support, learning context, and physical activity among 250 first- and second-year engineering students at S. Seifullin Kazakh Agrotechnical Research University. The conclusions are observational and associational.

Autonomous-motivation profile students reported the highest weekly activity (4.60 ± 1.20 days), followed by controlled-motivation (3.20 ± 1.00) and low-motivation students (1.40 ± 0.70); the between-profile difference was large, $F(2, 247) = 149.17$, $p < .001$, $\eta^2 = .547$.

Face-to-face and hybrid learning contexts showed higher descriptive mean activity than the distance context, but the available archived summary does not support a valid causal or inferential between-format conclusion.

Support from friends, support from teachers, and team participation were positively associated with physical activity ($r = .35-.48$, all $p < .001$), with team participation showing the strongest correlation.

Taken together, the findings support the pedagogical relevance of autonomy-supportive and socially supportive physical-education environments while underscoring the need for longitudinal and controlled research before causal mechanisms are inferred.

The practical implications are:

to consider students' motivational profiles when planning differentiated physical-education and engagement strategies;

to strengthen peer, teacher, and team-based support as elements of university activity programs;

to evaluate learning-context and digital initiatives with standardized measures and prospective designs rather than assuming effectiveness from cross-sectional differences.

Future research should replicate the profile structure using retained participant-level data, validated psychometric instruments, standardized physical-activity measurement, and samples from multiple universities.

The revised evidence therefore identifies meaningful associations among motivation, social support, learning context, and physical activity while keeping the strength of the conclusions proportionate to the available data.

Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

Declaration of the use of AI

Generative AI tools were used solely for language editing, translation, and improvement of clarity and readability during manuscript revision. They were not used to generate, modify, or analyze empirical data; calculate statistical results; create tables or figures; formulate research findings; or generate references. All scientific content, data, analyses, tables, interpretations, and references were reviewed and approved by the authors, who remain fully responsible for the manuscript.

Author Contributions

All authors contributed equally to all stages of the research, including conceptualization, methodology, data analysis, manuscript preparation, review, and editing. All authors have read and approved the final version of the manuscript.

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Received: 07.02.2026

Revised: 05.05.2026

Revised: 21.09.2026

Accepted: 30.09.2026

Published: 30.09.2026

Type of article: Research Article