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Influence of Gadget Usage Behaviour on Exercise Motivation and Psychosocial Well-Being of Adolescents in West Sumatra

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Abstract
This study investigates the relationship between gadget use, exercise motivation, and psychosocial well-being among 672 high school students in West Sumatra, Indonesia (aged 16–20). Using a cross-sectional design and PLS-SEM analysis, instruments measured gadget use (reliability 0.980), sport motivation (0.960), and psychosocial well-being (0.944). Results show gadget environment and negative impacts reduce motivation, while parental support increases it. Motivation strongly predicts psychosocial well-being ($\beta = 0.750$; $f^2 = 1.900$). The model explains 12.1% variance in motivation and 68.7% in well-being, with a good fit (SRMR = 0.065). Findings highlight parental support and digital control in enhancing adolescent health.

Keywords: Gadget use behaviour; exercise motivation; psychosocial well-being; adolescents

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1.0 Introduction

The development of digital technology has brought significant changes to people's lifestyles, especially among teenagers. Gadgets such as smartphones and tablets have become an integral part of teenagers' daily lives for communication, entertainment, learning, and social interaction. In Indonesia, the duration of daily digital media use is relatively high, indicating a strong dependence on mobile devices (Kemp, 2024). However, excessive gadget use is associated with a variety of problems, including decreased physical activity and mental health; in adolescents, high screen time is associated with greater odds of being inactive and with poorer health outcomes, while device use before bedtime is associated with poorer sleep quality (Zablotsky et al., 2025).

Adolescence is a crucial phase of physical, emotional, and social development. Physical activity/exercise supports physical health and psychosocial well-being, including improved mood, self-esteem, and the quality of social relationships; a meta-analysis shows that physical activity interventions reduce depressive symptoms in children and adolescents (Recchia et al., 2023). Globally, the majority of adolescents do not meet physical activity recommendations, indicating a gap in active behavior in this population. In Indonesia, recent findings also highlight the high level of sedentary behaviour among young people (Hanifah et al., 2023). At the same time, certain digital approaches—for example, exergames—can increase enjoyment and physical engagement, potentially shifting the function of devices from distractors to activity enablers.

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Especially in West Sumatra, known for its rich culture and strong social values, the shift to digital lifestyles presents new challenges for adolescents. Indications of nomophobia among local high school students highlight the need for attention to the intensity and quality of smartphone use within the school and family ecosystem (Hamdi & Gautama, 2024). In addition, social support from parents and peers has been shown to correlate with physical activity among adolescents in Indonesia, suggesting that the local socio-cultural context plays an important role in shaping exercise motivation (Yusuf et al., 2021)(Khan et al., 2020).

Based on this background, this study aims to investigate the relationship between gadget usage behaviour and exercise motivation and psychosocial well-being, and to explore the correlation between exercise motivation toward psychosocial well-being among adolescents in West Sumatra. The objectives of this study are: 1) To identify gadget usage behaviour, exercise motivation, and psychosocial well-being. 2) To determine the extent to which gadget usage behaviour affects exercise motivation and psychosocial well-being. 3) To establish a generally adequate model to demonstrate the role of gadget usage behaviour indicators on exercise motivation and psychosocial well-being. In line with the introduction, research aims, and objectives, the research hypotheses are formulated as follows: H1: There is a significant effect of gadget use on psychosocial well-being. H2: There is a significant effect of gadget use on exercise motivation. H3: There is a significant effect of exercise motivation on psychosocial well-being.

Nomenclature

SSE	Sum of Squares due to Error
SSO	Sum of Squares of Observations
SRMR	Standardised Root Mean Square Residual
d_ULS	Unweighted Least-Squares Discrepancy
d_G	Geodesic Discrepancy (global fit index in PLS)
NFI	Normed Fit Index

2.0. Literature Review

Gadget use among adolescents is a major challenge for today's generation because its impact is determined not only by the intensity of use but also by the social and environmental context. Misirli emphasized that the context of screen use—including parental involvement, peer dynamics, and content quality—acts as a mediator influencing the development of children's social and communication skills (Misirli, 2025). Similarly, environmental factors, such as community access to technology and family interaction patterns, are associated with children's and adolescents' screen time behaviour (Thompson et al., 2023). Family routines and financial conditions even influence screen exposure from an early age and potentially continue into adolescence. Alferez et al. emphasised the need for more specific metrics to measure the impact of electronic device use on focus and attention during learning activities (Alferez et al., 2025). Therefore, important indicators in assessing gadget use behaviour include the role of parents, the residential environment, the intensity of use, and the perceived impact.

In the context of sports, adolescents' proximity to gadgets can influence exercise motivation, which plays a crucial role in sports participation. Based on Self-Determination Theory, intrinsic motivation is key to building long-term exercise habits (Arey et al., 2022), especially when adolescents feel a sense of control and experience success (Junaidi et al., 2025). The link between gadget use behaviour and exercise motivation has the potential to determine adolescents' psychosocial well-being. Excessive gadget use is correlated with emotional and behavioural problems, such as depression and anxiety (Li et al., 2021)(Yewale et al., 2024), while intrinsic exercise motivation has been shown to support a healthier psychological state (Bebeley et al., 2021). To facilitate understanding and provide a more structured overview of the interrelationships between variables as discussed in the literature review, these are presented in the form of a conceptual framework in Fig. 1.

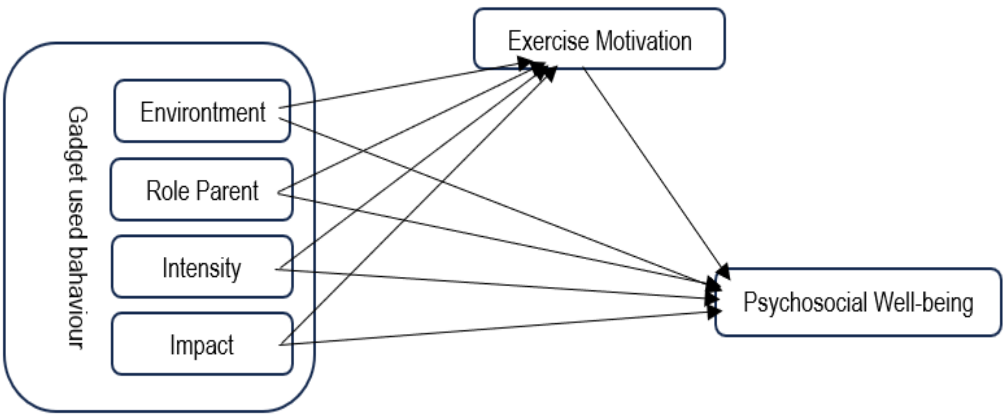

Fig. 1: Conceptual Framework

3.0. Methodology

This study was approved by the UiTM Research Ethics Committee and conducted in accordance with the Declaration of Helsinki and the Malaysian Good Clinical Practice Guidelines, with ethics approval number REC/10/2024 (PG/MR/538). This quantitative study used a cross-sectional design to analyse the relationship between gadget usage behaviour, exercise motivation, and psychosocial well-being among adolescents without manipulating the independent variables, thereby capturing real phenomena in the digital age. Participants consisted of 672 adolescents aged 16–20 years from secondary schools across all districts/cities in West Sumatra Province, Indonesia. The sample was dominated by females (65.9%), most of whom came from rural areas. Based on interest in sports, badminton (26.5%) and jogging (12.9%) were the most popular sports. Most participants reported good internet connectivity (55.8%) in their area, and most participants were from low to middle-income families (75.0% earning less than IDR 3,500,000 per month). Data was collected using three instruments: the Gadget Use Behaviour Scale, which measures the role of the environment, the role of parents, intensity and impact; the 16-item Sports Motivation Scale, which assesses intrinsic, extrinsic, and amotivation; and the Psychosocial Well-being instrument, which covers six dimensions, namely Social Integration, Social Contribution, Social Actualisation, Social Coherence, Social Acceptance, and Well-being. All instruments were tested on 55 participants and showed adequate test-retest reliability over a nine-day interval ($r > 0.266$). Data were analysed using PLS-SEM with SmartPLS through measurement and structural model evaluation to assess validity, reliability, and the hypothesised relationships among variables.

4.0. Result

4.1. Descriptive analysis

Descriptive analysis was conducted to describe the distribution of respondents for each research variable based on low, medium, and high categories. A summary of the analysis results is presented in Table 1 below.

Table 1. Descriptive table for each variable

Variable	Poor (%)	Moderate (%)	Good (%)	Key Trends
Sport Participation	10%	75%	15%	Most participants had moderate to high levels of sports participation (90%).
Exercise Motivation	28%	64%	8%	The majority of participants showed moderate to high levels of exercise motivation (72%).
Psychosocial Well-Being	19%	71%	10%	Participants generally had moderate to high levels of psychosocial well-being (81%).
Gadget Use Behaviour	14%	60%	26%	Mobile device usage behaviour is dominated by the moderate to good category (86%).

Based on the table, most respondents were in the moderate to high category for all variables. Sports participation and psychosocial well-being showed the highest proportions, at 90% and 81% respectively, followed by exercise motivation (72%) and gadget usage behaviour (86%). In general, these findings indicate that the respondents' conditions were relatively stable and not extreme.

4.2. Reliability and validity of the instrument

4.2.1. Outerloading

In the measurement model, the code GU indicates the Gadget Usage Behaviour indicator (e.g., GU11 = item 11 on gadget usage behaviour), MO indicates the exercise motivation indicator, and PS refers to the psychosocial well-being indicator. An explanation of these codes is necessary to clarify the differences between the constructs being analysed. Several indicators fall within the 0.40–0.70 range but are retained as they do not compromise the overall reliability and validity of the construct. For Intensity, GU11 and GU12 show high values, while GU13 is in the moderate category. GU19 represents impact with a very high value. Parents have GU1 with a high value, while GU3 and GU4 are moderate. In the Environment, GU5 is low, and GU7 is very high. Motivation shows varied values, with MO5, MO6, MO7, and MO8 above 0.70, while the others are moderate. Psychosocial Well Being is generally consistent, with most indicators above or close to 0.70, although PS3, PS6, and PS15 fall into the mild category. Overall, the indicators remain suitable for further analysis.

4.2.2. Construct validity and reliability

The following table presents the results of construct reliability tests, including Cronbach's Alpha, rho_A, Composite Reliability, and Average Variance Extracted (AVE) values. These tests were used to ensure that each construct in the model had adequate internal consistency and convergent validity.

Table 2. Value Composite reliability, Cronbach's α, AVE

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Environment	0.672	1,000	0.792	0.687
Impact	1,000	1,000	1,000	1,000
Intensity	0.789	0.838	0.804	0.585
Motivation	0.897	0.905	0.899	0.594
Parents	0.781	0.801	0.772	0.537
Psychosocial Well Being	0.943	0.944	0.943	0.581

All constructs met the reliability and convergent validity criteria: CR > 0.70 and AVE ≥ 0.50. Indicators with moderate loadings (0.40–0.69) were retained because they did not reduce AVE/CR, thus maintaining the constructs' overall validity and reliability.

4.2.3. Discriminant validity (Construct-level)

Discriminant validity checks whether each construct is truly distinct. Using the Fornell–Larcker criterion, a construct's square root of AVE must exceed its correlations with other constructs (i.e., the diagonal value is greater than all off-diagonal correlations in its row/column). If so, discriminant validity is established:

Table 3. Fornell-Larcker criterion

	Environment	Impact	Intensity	Motivation	Parents	Psychosocial Well Being
Environment	0.829					
Impact	0.623	1,000				
Intensity	0.688	0.578	0.765			
Motivation	-0.177	-0.285	-0.096	0.627		
Parents	0.764	0.596	0.733	-0.045	0.733	
Psychosocial Well Being	-0.184	-0.271	-0.096	0.826	-0.092	0.694

All constructs satisfied the Fornell–Larcker criterion (e.g., Environment √AVE = 0.829 > its correlations; Motivation √AVE = 0.627 > all related correlations), confirming strong discriminant validity. No inter-construct correlations exceeded 0.90, indicating no multicollinearity and a stable, theoretically coherent model.

4.2.4. Heterotrait-Monotrait ratio (HTMT)

The discriminant validity of the measurement model was tested using the Heterotrait–Monotrait Ratio (HTMT) to ensure empirical differences between latent constructs. The criterion used was an HTMT value < 0.90, and the test results are presented in Table 4.

Table 4. Heterotrait-Monotrait ratio (HTMT)

	Environtment	Impact	Intensity	Motivation	Parent	Psychosocial Well Being	Sport Participation
Environtment							
Impact	0.740						
Intensity	0.896	0.611					
Motivation	0.209	0.302	0.138				
Parent	0.829	0.609	0.763	0.141			
Psychosocial Well Being	0.202	0.270	0.102	0.827	0.100		
Sport Participation	0.190	0.237	0.162	0.781	0.113	0.707	

Based on the results shown in Table 4, all HTMT values between constructs are below the critical limit of 0.90, indicating that discriminant validity has been met.

4.3. Structural model results

4.3.1. Analysis of determination coefficient (R^2)

Table 5 shows the coefficient of determination (R Square) used to measure how much variation in an endogenous construct can be explained by the independent constructs in the model. The higher the R^2 value, the better the model's predictive ability for that variable.

Table 5. Value of determination coefficient (R Square)

	R Square	R Square Adjusted	Interpretation
Motivation	0.121	0.116	Weak (12.1%)
Psychosocial Well-Being	0.687	0.685	Strong (68.7%)

The structural model evaluation results show that the Sports Participation construct has an R^2 value of 0.635, indicating that the construct in the model can explain 63.5% of the variability in sports participation. The Psychosocial Well-being construct also has strong explanatory power (R^2 = 0.687). However, the Motivation construct only has an R^2 of 0.121, indicating that the independent variables in the model only explain a small amount of variation in respondents' motivation.

4.3.2. Multicollinearity analysis (Outer VIF Value)

The multicollinearity test using the Variance Inflation Factor (VIF) showed that all indicators had values below 3.3, indicating no multicollinearity issues within the measurement model. This confirms that the correlations between indicators in each construct are within acceptable limits, ensuring the stability and reliability of the model estimates.

4.3.3. Analysis of relationships between constructs (Path Coefficient – β Coefficient)

Path coefficient analysis in Structural Equation Modelling (SEM) determines the strength and direction of relationships between constructs in a structural model. Each path indicates the direct influence of one construct on another. The β (beta) value indicates the magnitude of the influence, while the T-value and P-value are used to test the significance of the influence. The following data are shown in the table.

Table 6. Path Coefficient – β Coefficient

Track	β (Original Sample)	T-Value	P-Value	Significant	Information
Environment → Motivation	-0.136	2,315	0.021	Yes	Significant negative impact
Environment → Psychosocial	-0.025	0.643	0.521	No	Not significant
Impact → Motivation	-0.334	6,532	0.000	Yes	Significant & strong negative impact
Impact → Psychosocial	-0.035	1,056	0.291	No	Not significant
Intensity → Motivation	0.064	1,159	0.247	No	Not significant
Intensity → Psychosocial	0.032	0.901	0.368	No	Not significant
Motivation → Psychosocial	0.750	29,402	0.000	Yes	The positive influence is very strong
Parent → Motivation	0.178	2,533	0.012	Yes	Significant positive effect
Parent → Psychosocial	-0.023	0.621	0.535	No	Not significant

The table showed that motivation is the central linkage in the model. Environment and Impact have significant negative effects on motivation, Parental support has a significant positive effect, and Intensity shows no effect. Motivation then has a very strong positive effect on psychosocial well-being. No direct significant effects were found from environment, impact, intensity, or parent on psychosocial well-being or sport participation.

4.3.4. Effect size analysis (f^2)

Effect size (f^2) analysis is used to determine the extent to which each exogenous construct influences the endogenous construct in the SEM model. The f^2 value indicates the strength of the influence of a path after a particular exogenous construct is removed from the model. Hair suggests interpreting the f^2 value as follows: 0.02 = small, 0.15 = medium, and 0.35 = large. An f^2 value below 0.02 is considered insignificant or weak in its contribution to the model(Hair et al., 2024). The following table presents the f^2 value for each path in the model, along with an interpretation of the level of influence on the construct:

Table 7. Value Effect Size – f^2 and its interpretation

Path	f^2 Value	Interpretation
Environment → Motivation	0.018	Not significant
Impact → Motivation	0.079	Small effect
Intensity → Psychosocial Well-Being	0.004	Not significant
Parent → Motivation	0.034	Small effect
Parent → Psychosocial Well-Being	0.007	Not significant
Motivation → Psychosocial Well-Being	1,900	Large effect

The only large effect is the effect of Motivation on Psychosocial Well-Being (f^2 = 1.900). Two small effects occur on motivation: the effect of Impact on Motivation (f^2 = 0.079) and the effect of Parental support on Motivation (f^2 = 0.034). Others are not significant: Environment on Motivation (0.018), Intensity on Psychosocial Well-Being (0.004), and Parental support on Psychosocial Well-Being (0.007). This underscores motivation's central role.

4.3.5. Prediction relevance analysis (Q^2)

Q-square from the blindfolding procedure assesses how well the model predicts its endogenous constructs. In general, a Q-square value above zero indicates predictive ability: around 0.02 is small, around 0.15 is medium, and above 0.35 is large. A value of zero or below means no predictive ability(Hair et al., 2024). The following table presents the SSO, SSE, and Q^2 values for each construct in the model along with their interpretation:

Table 8. Value prediction relevance – Q^2

	SSO	SSE	Q^2 (=1-SSE/SSO)	Interpretation
Environment	1344,000	1344,000		
Impact	672,000	672,000		
Intensity	2016,000	2016,000		
Motivation	8736,000	8327.082	0.047	Small → weak prediction
Parents	2016,000	2016,000		
Psychosocial	12096.000	8533.903	0.294	Medium–high → prediction is quite strong

Blindfolding shows varied predictive ability: fairly strong for psychosocial well-being (0.29), and weak for motivation (0.047, still above the minimal threshold). Overall, the model predicts psychosocial well-being best and motivation least.

4.3.6. Model fit evaluation

PLS-SEM model fit is assessed with SRMR, d_ULS, d_G, Chi-Square, and NFI. SRMR is the primary criterion; values below 0.08 indicate good fit (Hair et al., 2024). The table reports these indices for the saturated and estimated models, providing an overall judgment of how well the model matches the data:

Table 9. Values from model fit

Indicator	Saturated Model	Estimated Model	Interpretation
SRMR	0.065	0.065	Good fit (below 0.08)
d_ULS	6,980	6,980	
d_G	1,937	1,937	
Chi-Square	6930.945	6930.945	
NFI	0.679	0.679	

Based on the model fit calculation results in SmartPLS, the SRMR value for the model was 0.065, indicating a good fit, as it was below the threshold of 0.08. Although the NFI value of 0.679 was still below the ideal criteria (>0.90), the SRMR indicated that the model was generally adequate.

5.0. Discussion

Based on PLS-SEM estimates, the model demonstrated strong explanatory power for psychosocial well-being, while its explanatory power for motivation was relatively limited. Consistency between explanatory power and predictive relevance indicates that the model structure performs well for psychosocial outcomes, although it needs further refinement to explain variation in motivation. Model fit was also adequate according to the approximate fit criteria commonly used in PLS-SEM, and no significant multicollinearity issues were observed at the indicator level, allowing for confident interpretation of the path estimates.

The pathway from motivation to psychosocial well-being is a key explanatory factor in the model. Theoretically, when adolescents have more autonomous motivation and feel competent and socially connected through physical activity, they tend to experience more positive moods, better self-esteem, and stronger social relationships—all of which contribute to higher psychosocial well-being. Within the framework of Self-Determination Theory, fulfilling the basic needs of autonomy, competence, and relatedness through physical activity fosters autonomous motivation, which in turn improves these indicators of psychological well-being (Arey et al., 2022). The consistency of this pathway is further strengthened by meta-analytic evidence showing that physical activity interventions can reduce depressive symptoms in children and adolescents, supporting the claim that increased motivation to engage in activity is associated with more adaptive psychological outcomes (Recchia et al., 2023).

Parental support is positively associated with motivation, although its strength is not dominant. Within the framework of Self-Determination Theory, autonomy support—for example, providing activity choices, avoiding control, and affirming competence—encourages self-regulation and intrinsic interest, thus increasing the quality of motivation (Teixeira et al., 2012). Consistent with Social Cognitive Theory, parental modelling of active habits and verbal reinforcement strengthen adolescents' self-efficacy, leading to greater persistence and engagement in physical activity (Hamilton et al., 2024). From the perspective of Expectancy–Value Theory, the beliefs and values conveyed by parents shape adolescents' expectations of success and task value, which in turn strengthen their intention to participate consistently (Eccles & Wigfield, 2024). From the Theory of Planned Behaviour, parental support increases adolescents' subjective norms and perceived behavioural control, making it easier to realise intentions and actual efforts to exercise (Hagger & Hamilton, 2025). Findings from the Indonesian context also indicate that social support from parents and peers correlates with adolescents' physical activity levels, suggesting that interventions involving families have the potential to sustainably increase motivation (Yusuf et al., 2021).

Conversely, perceived environmental barriers and perceived negative impacts associated with device use tend to erode motivation. Within the time displacement framework, screen time displaces opportunities for physical activity, increasing sedentary behaviour and decreasing opportunities to exercise (Stiglic & Viner, 2019). The mechanism of sleep disruption occurs when screen use near bedtime delays sleep onset, reduces sleep duration/quality, and increases next-day fatigue, which in turn decreases energy and intention to exercise (Carter et al., 2016). Furthermore, the instant reward loop of passive digital consumption—through rapid stimuli and immediate rewards—reinforces preferences for low-energy-cost activities and weakens self-regulation to engage in effortful physical activity (Zablotsky et al., 2025). Thus, the pattern of negative associations between screen exposure, environmental barriers, and lower exercise motivation is consistent with empirical evidence across recent systematic reviews and population data.

Practical implications suggest that interventions should prioritise motivation, fostering autonomy, competence, and connectedness. An autonomy-supportive approach to parental engagement can be combined with digital hygiene—reducing notifications and pre-bedtime use—and transforming devices into physical activity enablers through progress monitoring, timely reminders, community features, and gamification focused on skill acquisition. This suite of strategies is consistent with evidence that appropriate social support and thoughtful digital design can increase engagement, adherence, and the psychosocial benefits of physical activity in adolescents (Arigo et al., 2020).

6.0. Conclusion

PLS-SEM results indicate that the model can robustly explain adolescents' psychosocial well-being. However, the explanation for the variance in motivation is still limited and requires additional factors. Motivation proved to be a key link between device use behavior and psychosocial well-being: the dimensions of impact (perceived negative impact) and environment (environmental barriers or conveniences) suppressed motivation, while parental role (autonomy-supportive parental support) increased motivation; intensity (duration and frequency of use) did not show a significant direct effect after the quality of use was taken into account. Therefore, effective interventions need to minimise the negative impact of screens through digital hygiene, reduce environmental barriers by providing supportive physical facilities, strengthen the role of parents in regulating device use in a supportive manner, and transform devices into enablers of physical activity through progress monitoring, reminders, online communities, and mastery-oriented gamification. This integrated, motivation-centric approach is expected to increase motivation to participate in sports and sustainably strengthen adolescents' psychosocial well-being.

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Paper Contribution to the Related Field of Study

This paper enriches the adolescent health and sport sociology literature by modelling four dimensions of gadget use behaviour (impact, intensity, parental role, and environment).

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