



Effects of outdoor physical activity on behavioural regulation among Malaysian university students

Efectos de la actividad física al aire libre en la regulación conductual entre estudiantes universitarios de Malasia

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Abstract

Introduction: Outdoor physical activity is recognized as an effective pedagogical approach for enhancing behavioural regulation, social competence, and psychosocial well-being. However, its role in reducing maladaptive behaviours among university students, particularly in Malaysia, remains underexplored.

Objective: This quasi-experimental study examined the effects of a structured outdoor physical activity programme on aggression, peer relationships, and self-regulation among 90 Malaysian undergraduates in a physical education course.

Methodology: Participants were assigned to a treatment or control group and completed three validated instruments at three measurement points: the Peer Relationship Index (IPR), the Personal Self-Concept Questionnaire (PSC), and the Aggressive Behaviour Questionnaire. The intervention, based on experiential learning and the Teaching Personal and Social Responsibility (TPSR) model, integrated cooperative tasks, reflective activities, and moderate-to-vigorous physical activity. Data were analyzed using descriptive statistics, regression analysis, t-tests, one-way ANOVA, and mixed-design repeated measures ANOVA.

Results: Results indicated that positive peer relationships consistently predicted lower aggression levels (Pre-test $\beta = -.367$; Post-test 1 $\beta = -.531$; Post-test 2 $\beta = -.519$; $p < .001$). The treatment group showed significant improvements compared to the control group ($F = 6.11$, $p = .003$).

Discussion and Conclusion: These findings highlight the potential of structured outdoor physical activity to promote behavioural regulation in higher education.

Keywords

Outdoor physical activity; Physical Education; behavioural regulation; peer relationship; aggression.

Resumen

Introducción: La actividad física al aire libre se reconoce como un enfoque pedagógico eficaz para mejorar la regulación conductual, la competencia social y el bienestar psicosocial. Sin embargo, su papel en la reducción de conductas desadaptativas entre los estudiantes universitarios, especialmente en Malasia, sigue sin explorarse.

Objetivo: Este estudio cuasi-experimental examinó los efectos de un programa estructurado de actividad física al aire libre sobre la agresión, las relaciones con los iguales y la autorregulación entre 90 estudiantes malayos de grado en un curso de educación física.

Metodología: Los participantes fueron asignados a un grupo de tratamiento o control y completaron tres instrumentos validados en tres puntos de medición: el Índice de Relación entre Pares (IPR), el Cuestionario de Autoconcepto Personal (PSC) y el Cuestionario de Conducta Agresiva. La intervención, basada en el aprendizaje experiencial y el modelo de Responsabilidad Personal y Social Docente (TPSR), integró tareas cooperativas, actividades reflexivas y actividad física moderada a vigorosa. Los datos se analizaron utilizando estadística descriptiva, análisis de regresión, pruebas t, ANOVA unidireccional y ANOVA de medidas repetidas de diseño mixto.

Resultados: Los resultados indicaron que las relaciones positivas entre iguales predijeron consistentemente niveles más bajos de agresividad (Pre-test $\beta = -.367$; Tras la prueba 1 $\beta = -.531$; Prueba 2 $\beta = -.519$; $p < .001$). El grupo de tratamiento mostró mejoras significativas en comparación con el grupo de control ($F = 6,11$, $p = 0,003$).

Discusión y Conclusiones: Estos hallazgos destacan el potencial de la actividad física estructurada al aire libre para promover la regulación conductual en la educación superior.

Palabras clave

Actividad física al aire libre; Educación Física; regulación conductual; reacciones entre pares; agresividad.

Introduction

Physical education (PE) and sport sciences emphasise the role of structured physical activity in shaping behavioural, cognitive, and psychosocial development. Outdoor physical activity provides a meaningful context for experiential learning, self-regulation, and social skill development through cooperative challenges and physical engagement. Activities such as hiking, team-based problem-solving tasks, and adventure-oriented programmes encourage communication, responsibility, emotional control, and peer interaction—competencies closely aligned with behavioural regulation in PE (Hellison, 2011; Mañanas-Iglesias et al., 2023; Walters et al., 2025).

Recent studies also highlight that outdoor education programs play a crucial role in promoting social competence and emotional development, particularly in reducing youth aggression (Son & Berdychevsky, 2024). In addition, research by Arce-Larrory, Velasco, & Sáez, (2024) has demonstrated that physical education curricula, when enriched with outdoor learning experiences, foster an environment conducive to developing social skills and promoting responsible behaviors among students. These findings align with the positive impacts of outdoor education on children's cognitive and social development (Kabadayı, Sapsağlam & Karadimitriou, 2025), confirming the effectiveness of structured outdoor activities in educational contexts."

Moreover, these outdoor activities have been shown to improve psychosocial well-being and peer relationships, and may contribute to reducing maladaptive behaviors through cooperation and shared challenges (Mañanas-Iglesias et al., 2023; Walters et al., 2025). Previous studies also show that structured outdoor education programs can foster social responsibility and reduce aggressive behaviors by promoting prosocial behaviors among participants (McAllister & Smith, 2023; Carter, 2021). In higher education, issues such as aggression, social conflict, and maladaptive behaviors that affect student well-being and learning outcomes continue to be significant challenges. Although recreational and outdoor education have expanded, research on the effects of structured outdoor physical activity interventions in university PE curricula in Southeast Asia remains limited (Walters et al., 2025; Cary et al., 2024; Johnson & Green, 2022).

From a pedagogical perspective, outdoor physical activity aligns with established instructional models used in physical education, including experiential learning approaches and the Teaching Personal and Social Responsibility (TPSR) model. The TPSR model, developed by Hellison (2011), emphasises respect, effort, self-direction, leadership, and the transfer of responsible behaviour beyond the activity setting. When applied in outdoor and adventure-based tasks, TPSR offers a structured pathway for developing social responsibility and behavioural self-control in authentic, physically demanding environments.

Prior studies indicate that outdoor and adventure-based programmes can improve peer relationships and aspects of psychosocial well-being, and may contribute to reductions in maladaptive behaviours through cooperation and shared challenges (Mañanas-Iglesias et al., 2023; Walters et al., 2025). In higher education contexts, aggression, social conflict, and other maladaptive behaviours remain concerns that may affect student well-being and learning. Although recreational and outdoor education has expanded, fewer studies have examined structured outdoor physical activity as an intentional behavioural intervention within university PE curricula, particularly in Southeast Asia.

This study addresses this gap by examining the effects of a structured outdoor physical activity programme grounded in PE pedagogy on behavioural regulation among Malaysian university students. The study focuses on aggression, peer relationships, and self-concept across three measurement points, clarifying psychosocial pathways through which outdoor physical activity may influence student behaviour.

Objective

The objectives of this study were to:

1. Examine the effects of a structured outdoor physical activity programme on aggressive behaviour among Malaysian university students, which aligns with findings by Penrose & Fisher (2021) Williams (2024) about the influence of outdoor activities on aggression.



2. Determine the role of peer relationships in predicting aggressive behaviour across multiple measurement points, building on research that suggests that cooperative outdoor activities promote positive peer interactions (Carter & Turner, 2019; Walters et al., 2025).
3. Assess whether self-concept significantly predicts aggressive behaviour following participation in an outdoor physical activity programme, which reflects earlier research by Cary et al. (2024) and Sadkowiak (2025), highlighting the long-term influence of outdoor education on self-concept development.

Method

Research Design

A quasi-experimental research design with purposive sampling was employed to examine the effects of an outdoor physical activity programme on behavioural and psychosocial outcomes. This design enabled implementation within an authentic PE context where random assignment was not feasible (Tabatabaeian & Nematizadeh, 2024). Furthermore, previous research shows that experiential learning approaches and the TPSR (Teaching Personal and Social Responsibility) model are highly effective in enhancing self-regulation and social responsibility skills among students (Hellison et al., 2025; Park, Yun & Yli-Piipari, 2025). This program also utilizes principles of experiential learning to enhance social interaction and self-control, focusing on cooperation, communication, and personal responsibility. For example, Morales-Giner et al., (2026) found that outdoor-based learning programs significantly improve students' awareness and management of social behavior.

Participants

Participants consisted of 90 undergraduate students enrolled in a third-year physical education and recreation course at a Malaysian public university. Inclusion criteria required enrolment in the course, full participation in the programme (treatment group), and completion of all three measurement points (pre-test, post-test 1, and post-test 2). Participants were allocated to either a treatment group or a control group based on course scheduling constraints.

Outdoor Physical Activity Programme

The intervention comprised a three-day structured outdoor physical activity module integrating moderate-to-vigorous physical activity, cooperative group tasks, and reflective learning activities. Daily activities included hiking (3–5 km), water-based activities, and team challenges, with an estimated cumulative physical activity duration of 6–8 hours per day and intensity levels ranging from approximately 5 to 8 metabolic equivalents (METs). The programme was guided by experiential learning principles and TPSR, emphasising cooperation, communication, self-management, and personal responsibility. Group processes were structured according to Tuckman's stages of group development (forming, storming, norming, performing, and adjourning) to support group cohesion and behavioural engagement.

Instruments

Peer Relationship Index (IPR). The IPR assessed perceived peer support and social interaction. Items were rated on a Likert-type scale; higher scores indicate more positive peer relationships.

Personal Self-Concept Questionnaire (PSC). The PSC measured self-perceptions related to self-worth, self-management, and personal competence. Responses were recorded using a Likert-type scale; higher scores indicate more positive self-concept.

Aggressive Behaviour Questionnaire. Aggressive behaviour was assessed using a questionnaire capturing physical and verbal aggression. Higher scores indicate higher levels of aggressive behaviour.

Procedure and Ethical Considerations

Participants received study information and provided written informed consent prior to data collection. The study was conducted in accordance with the principles of the Declaration of Helsinki. The treatment group completed the outdoor physical activity programme, while the control group continued with regular academic and co-curricular activities. In line with ethical guidance, participants in the control

group were offered the opportunity to participate in the outdoor physical activity programme after completion of the study.

The study respondents, namely the treatment group and the control group, had to first answer a set of questionnaire forms as a pre-study test at the beginning of the semester before the programme intervention was conducted. The second step was that the treatment group had to undergo an intervention, namely an outdoor education and recreation programme that had been scheduled by the Faculty of Education UKM. One to three days after the completion of the programme, both the treatment group and the control group were given the same set of questionnaire forms by the researchers to be answered as a post-study test. The researchers had chosen a short period of time after the completion of the outdoor education and recreation programme because, according to Tabatabaeian and Nematizadeh (2024), in their study titled *Exploring Memory Systems: Types, Processes, and Implications for Learning and Teaching*, it was stated that to obtain feedback requiring reflection but still closely related to a specific experience, a period of one to three days was optimal to maintain the relevance and accuracy of memory. They also stated that if the goal was to get very detailed feedback on sensory experiences or feelings immediately after a particular activity, the feedback should be collected immediately.

Program Implementation

Logistics management was fully managed by the program participants and was regulated by a line of facilitators who were monitored by the lecturers of this subject for all aspects such as location, equipment, vehicles, food, and other requirements for programming.

For each day, the implementation of activities or tentative daily programs was guided by Tuckman's Stages of Group Development. The Tuckman Group Development Stage Model was a widely used framework for understanding group dynamics and how groups evolved toward effective collaboration. Proposed by Bruce Tuckman in 1965 and later refined with Mary Ann Jensen in 1977, this model outlined the five stages that the group went through, namely forming, storming, norming, performing, and adjourning. In the context of a study by researchers examining the factors and role of outdoor and recreational education programs in preventing deviant behavior, understanding this model helped maximize the effectiveness of group activities.

Monitoring and Evaluation

Periodic assessments were conducted throughout the program to measure the progress and impact of interventions on participants' behavior. Ecological Momentary Assessment had been shown to influence participants' behavior by increasing awareness and accountability. Although it could also trigger negative emotions and behaviors, the need for careful ongoing evaluation was considered in behavioral studies (Stevens 2024). The implementation of continuous interventions was another critical factor because the extent to which the researchers adhered to the designed method significantly influenced the outcome (King-Sears & Garwood 2020).

Data analysis

Data were analysed using SPSS version 29. Descriptive statistics were calculated (means and standard deviations). Pearson correlation and regression analyses examined relationships among variables. Group differences were tested using independent-samples t-tests and one-way ANOVA. Change over time was examined using mixed-design repeated measures ANOVA.

Results

The results of the study show that peer relationships were the strongest predictor in reducing aggressive behavior among participants.

Peer Influences and Aggression

Regression analyses showed peer influence as a significant negative predictor of aggression at all stages: - Pre-test: $\beta = -.367$, $p < .001$ - Post-test 1: $\beta = -.531$, $p < .001$ - Post-test 2: $\beta = -.519$, $p < .001$



This indicates that participation in outdoor physical activity enhanced prosocial peer interactions that supported behavioural regulation. These findings confirm those by Walters et al. (2025) and Penrose & Fisher (2021), who suggest that positive peer interactions play a key role in reducing aggression and promoting prosocial behavior.

Self-Concept and Aggression

Meanwhile, the study found that self-concept did not significantly affect aggressive behavior at all stages, which may reflect that changes in self-perception require more interventions or a longer period of time to show measurable effects (Cary et al., 2024). This finding is consistent with Eglitis et al. (2024), who showed that the formation of self-concept in short-term programs does not have a significant impact on reducing negative behaviors, but more substantial changes are seen when programs are longer.

Demographic Differences

No significant differences in aggression were found based on gender, education level, income group, or parenting style. The results of the present study indicate that no significant differences in aggression were found based on gender, education level, income group, or parenting style among the participants. This suggests that within the context of Malaysian higher education, these standard demographic variables alone do not reliably predict aggressive behaviour, pointing toward the influence of other psychosocial and contextual factors beyond demographic categories.

Recent research in Malaysia's tertiary education supports this notion by emphasizing that aggressive and related behaviours (e.g., cyberbullying) are influenced more by social, cognitive, and environmental factors than by simple demographic distinctions. For instance, a study on Malaysian tertiary students' cyberbullying behaviour found that the intention to engage in online aggression is shaped by complex determinants such as peer relationships, perceived behavioural control, and university climate, rather than by straightforward demographic traits like gender or socioeconomic status alone (Rahman et al., 2023).

Similarly, research investigating cyberbullying and its psychological impacts among Malaysian university students highlights that while aggressive behaviour online is prevalent, patterns of perpetration and victimisation vary widely and are mediated by situational and interpersonal factors, with demographics showing inconsistent effects when examined in isolation. This suggests that higher education students' behaviours related to aggression are more intricately linked to their social context, attitudes, and online interactions than to demographic profiles per se (Nazirah Hassan & Norshahidah Isa, 2024).

Effects of the Physical Activity Programme

A mixed-design repeated measures ANOVA revealed: - non-significant main effect of time ($p = .066$); - significant Time \times Group interaction ($F = 6.11$, $p = .003$), indicating different behavioural trajectories between groups; - the treatment group showed meaningful behavioural improvements over time compared to the control group.

Physical Activity Effects

Independent t -tests showed: - significant group differences at Post-test 1 ($p < .001$); - no significant differences at Post-test 2, suggesting temporary but impactful behavioural effects. The results from the independent t -tests reveal a significant difference between groups at Post-test 1 ($p < .001$) followed by no significant difference at Post-test 2, suggesting that participation in physical activity elicited immediate behavioural effects that were impactful in the short term but not sustained over a longer period without continued engagement. These findings align with recent research indicating that physical activity interventions can produce observable improvements in behaviour and psychological outcomes among university students immediately following an intervention, such as reductions in stress, anxiety, and aggression-related tendencies, but that these effects may attenuate over time once the structured activity ceases (Martín-Rodríguez et al., 2025).

Discussion

In line with the study objectives, the findings support the pedagogical value of structured outdoor physical activity programmes for promoting behavioural regulation among university students. As noted by Abusleme-Allimant et al. (2023) and Hellison (2025), structured outdoor physical education not only enhances physical health but also facilitates key behavioral changes in students, fostering self-regulation and social responsibility.

Consistent with TPSR and experiential learning principles, peer relationships emerged as the strongest predictor of reduced aggressive behaviour. Zhou et al. (2025) and Veiga et al. (2023) emphasize that peer interactions, particularly in outdoor settings, play a crucial role in shaping youth behavior and promoting positive social outcomes.

Cooperative physical tasks and shared challenges appear to foster positive social interactions that support self-regulation and responsible behaviour. Research by Bharti (2025) and Velamazán Martínez (2024) demonstrates that engaging in collaborative outdoor activities not only improves peer relationships but also enhances cooperation, which in turn contributes to improved self-regulation among participants. Furthermore, outdoor learning environments encourage self-regulation and responsible behavior. Albedry (2023) and A. Ghani et al. (2025) have found that outdoor education programs, particularly those based on adventure learning, significantly improve students' ability to manage emotions and engage in responsible social behaviors.

In the context of higher education, this temporal pattern highlights the importance of sustained physical activity programmes or ongoing behavioural support mechanisms to reinforce and prolong the positive effects observed at early post-test stages. Without such continuity, the short-term benefits, while statistically significant and meaningful, may not translate into long-term behavioural change. These findings echo broader evidence advocating for strategic and sustained implementation of physical activity interventions to maximise lasting psychological and behavioural outcomes among university students (Ari-santi et al., 2026).

As suggested by Lankford & York (2021), fostering cooperative peer interactions through structured outdoor activities is key to enhancing emotional and social competence in university students. Although behavioural improvements were observed following the intervention, the absence of significant effects for self-concept suggests that identity-related constructs may require longer-term or repeated interventions to demonstrate measurable change. This aligns with evidence that self-regulatory capacities can shift over shorter timeframes, whereas broader self-perceptions typically develop more gradually (Cary et al., 2024).

Using the TPSR approach, which emphasizes active involvement in social learning, this study also supports the theory that structured learning through outdoor activities can improve peer relationships, reduce aggression, and enhance social responsibility among university students (Hellison, 2011; Johnson & Green, 2022).

Limitations

First, the intervention duration was short, which may have limited the sustainability of behavioural changes. Second, the sample was drawn from a single Malaysian university, which may restrict generalisability. Third, behavioural outcomes were assessed via self-report, which may be subject to response bias.

Future Recommendations

Future research should use longitudinal designs to examine longer-term programme effects. Semester-long or repeated interventions may provide stronger evidence for sustained changes in aggression and self-concept. According to Lebeau et al. (2024) and Strande et al. (2025), long-term and repeated interventions, such as semester-long programs, provide stronger evidence of sustained changes in aggressive behavior and self-concept.

Studies should also expand sampling across institutions and consider mixed-method approaches (e.g., observation or interviews) to strengthen understanding of behavioural mechanisms. As highlighted by Thomas et al. (2023) and Wang et al. (2024), broader sampling ensures that the results are not limited



by the characteristics of a single university, allowing for a more comprehensive understanding of the effects of outdoor physical activity programs in diverse academic contexts.

Future research should consider employing mixed-method approaches, combining quantitative measures with qualitative techniques such as interviews and observations. Collins (2025) and Lawrence & Mowatt (2024) suggest that this combination provides a deeper understanding of how outdoor physical activity influences behavioral outcomes, offering insights into the psychosocial mechanisms at play.

Conclusions

Structured outdoor physical activity programmes grounded in PE pedagogy can positively influence behavioural regulation among university students. Peer relationships play a central role in reducing aggressive behaviour, highlighting the importance of cooperative and socially oriented physical activity tasks. These findings support integrating outdoor experiential learning within higher education PE curricula as a strategy for promoting responsible and prosocial behaviour.

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Appendix A

Informed Consent Form (Anonymous)

You are invited to participate in a study examining the effects of a structured outdoor physical activity programme on behavioural and psychosocial outcomes among university students. Participation is voluntary. You may withdraw at any time without penalty. Your responses will be kept confidential and analysed only in aggregate form. No identifying information will be collected in the questionnaire. By signing below, you confirm that you are at least 18 years old, have read the study information, and agree to participate.

Participant signature: _____ Date: _____