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Discipline in practice and study: A cross-sectional study on grit and academic engagement in combat sport athletes

Disciplina en la práctica y el estudio: un estudio transversal sobre la determinación y el compromiso académico en atletas de deportes de combate

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Abstract

This study explores the dual role of grit, physical and academic grit in influencing academic engagement among student combat sports athletes. While previous research emphasizes grit within either academic or athletic domains, few studies have examined how these two dimensions interact to affect educational outcomes. The primary aim of this study was to examine the predictive role of physical education grit, specifically physical and academic grit, on academic engagement. A cross-sectional design was employed, involving 496 student combat sports athletes ($M = 19.45$; $SD = 1.89$) from various state colleges and universities in the Philippines. Participants were selected through random sampling and completed validated instruments: the Physical Education Grit Scale (PE-GRIT), which includes physical and academic grit subscales, and the Utrecht Work Engagement Scale for Students (UWES-9), which measures vigor, dedication, and absorption. Data were analyzed using bivariate correlations and multiple regression techniques. The results showed that both physical grit ($\beta = 0.328$, $p < .001$) and academic grit ($\beta = 0.242$, $p < .001$) were significant predictors of academic engagement. These findings suggest that grit developed through combat sports practice extends beyond the physical domain and positively influences students' academic behaviors. Thus, physical education grit plays a crucial role in enhancing academic engagement by fostering discipline, persistence, and resilience. Combat sports training may serve as a valuable intervention that supports both physical development and academic success.

Keywords: grit; physical education; engagement; resilience

Resumen

Este estudio explora el papel dual de la determinación (grit), tanto física como académica, en la influencia sobre el compromiso académico de los estudiantes atletas de deportes de combate. Aunque investigaciones previas han enfatizado la determinación en los ámbitos académico o deportivo por separado, pocos estudios han examinado cómo interactúan estas dos dimensiones para afectar los resultados educativos. El objetivo principal de este estudio fue examinar el papel predictivo de la determinación en educación física, específicamente la determinación física y académica, sobre el compromiso académico. Se empleó un diseño transversal con la participación de 496 estudiantes atletas de deportes de combate ($M = 19.45$; $DE = 1.89$) de diversas universidades y colegios estatales de Filipinas. Los participantes fueron seleccionados mediante muestreo aleatorio y completaron instrumentos validados: la Escala de Determinación en Educación Física (PE-GRIT), que incluye subescalas de determinación física y académica, y la Escala de

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Compromiso Académico para Estudiantes de Utrecht (UWES-9), que mide vigor, dedicación y absorción. Los datos fueron analizados mediante correlaciones bivariadas y técnicas de regresión múltiple. Los resultados mostraron que tanto la determinación física ($\beta = 0.328$, $p < .001$) como la determinación académica ($\beta = 0.242$, $p < .001$) fueron predictores significativos del compromiso académico. Estos hallazgos sugieren que la determinación desarrollada a través de la práctica de deportes de combate trasciende el ámbito físico e influye positivamente en las conductas académicas de los estudiantes. Por lo tanto, la determinación en educación física desempeña un papel crucial en la mejora del compromiso académico al fomentar la disciplina, la perseverancia y la resiliencia. El entrenamiento en deportes de combate puede servir como una intervención valiosa que apoye tanto el desarrollo físico como el éxito académico.

Palabras clave: determinación; educación física; compromiso; resiliencia

Introduction

Recently, the concept of grit—characterized by enduring passion and perseverance towards long-term objectives—has attracted interest in educational and psychological research for its potential to forecast success across various areas (Duckworth et al., 2007; Duckworth & Gross, 2014). This non-cognitive attribute is especially pertinent to student-athletes, who are required to sustain unwavering effort and concentration in both academic and athletic pursuits (Christopoulou et al., 2018; Hodge et al., 2017). Despite the increasing interest, research on the functioning of grit in dual roles—academic and physical—remains scarce, especially within the realm of combat sports, which uniquely integrates physical discipline and cognitive engagement (Andreato et al., 2022; Mojtahedi et al., 2023).

Combat sport practitioners constitute a unique population where the integration of mental and physical discipline may provide valuable perspectives on enhancing engagement (Kim, 2023; Xu et al., 2022). Various studies have examined combative sports as both a sport and a discipline, play a pivotal role in fostering resilience, focus, and self-regulation among practitioners (Cao and Lyu, 2024; Chen, 2024). These traits are often linked to improved cognitive and behavioral outcomes, including enhanced problem-solving skills, emotional regulation, and persistence in achieving goals (Hadiana et al., 2022; Xu et al., 2022; Cao and Lyu, 2024). However, the specific mechanisms through which combat sports training contributes to academic engagement remain poorly understood. By combining physical rigor with mental resilience, combat sports may

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uniquely cultivate both physical grit and academic grit, reflected in perseverance with educational tasks (Lee et al., 2021; Tannoubi et al., 2023; Hadiana et al., 2022). Investigating these dynamics offers an opportunity to uncover how such training translates to higher levels of school engagement and provides actionable insights for leveraging combat sports as a tool for holistic student development.

The Role of Combat Sports in Cultivating Determination and Resilience

Combat sports, including Taekwondo, Karate, and Arnis, are characterized by their physical rigor as well as their focus on mental discipline, self-control, and tenacity (Mojtahedi et al., 2023; Andreato et al., 2022). Such sports necessitate unwavering dedication to intensive training, proficiency in intricate procedures, and the capacity to withstand physical and psychological adversities—elements that intrinsically foster the cultivation of resolve and resilience (Hadiana et al., 2022; Cao & Lyu, 2024). Determination, frequently linked to perseverance, is developed in combat sports through the continuous process of failing, learning, and mastery. Practitioners often encounter circumstances that need perseverance to surmount obstacles, such as competitive loss, physical fatigue, or technological challenges (Lozano-Jiménez et al., 2021). This process reflects the elements of grit delineated by Duckworth et al. (2007), specifically endurance of effort and sustained interest across time. Resilience, characterized as the capacity to rebound from difficulties and adjust favorably to adversity, is a trait deeply rooted in the culture of combat sports (Massey & Whitley, 2023; Blanco-García et al., 2021). Training environments cultivate resilience by necessitating that athletes endure discomfort, regulate emotional reactions under duress, and recover from setbacks (Andreato et al., 2022).

Research indicates that the resilience acquired via combat sports involvement transcends the sport, impacting psychological well-being and coping strategies in academic and social contexts (Kim, 2019; Xu et al., 2022). Moreover, the organized and methodical characteristics of combat sports foster self-regulation and emotional control—essential elements of both determination and resilience (Hadiana et al., 2022; Lozano-Jiménez et al., 2021). A study of Tannoubi et al. (2023) assert that combat sports athletes exhibit elevated levels of intrinsic motivation, goal orientation, and sustained attention

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relative to their non-sporting counterparts. These attributes are essential in promoting academic involvement and sustained personal growth.

For student-athletes in higher education, the mental and physical demands of combat sports function as a dual-purpose intervention, improving both physical ability and vital life skills. This twofold advantage establishes combat sports as a distinctive and efficacious channel for cultivating non-cognitive attributes vital for academic achievement and larger life issues.

Physical Education Grit

Grit is characterized as the combination of passion and perseverance directed toward long-term objectives, comprising two components: consistency of interest and perseverance of effort (Duckworth & Gross, 2014; Tannoubi et al., 2023). Consistency of interest denotes the inclination to pursue identical objectives over time, while perseverance of effort signifies the propensity to exert effort despite facing obstacles. The two domains of grit have been examined in various populations, across multiple academic levels (Datu et al., 2021; Dunston et al., 2020). Grit has recently garnered heightened attention in the field of education (Christopoulou et al., 2018; Daniels et al., 2021). Grit is the steadfast and fervent pursuit of long-term objectives, comprising two elements: perseverance of effort, which is the tendency to persistently exert oneself despite encountering obstacles, and consistency of interest, the propensity to sustain the same goals and interests over time (Credé et al., 2017; Muenks et al., 2018). Numerous studies have shown grit as a robust predictor of accomplishment (Hodge et al., 2017; Daniels et al., 2021), whereas conscientiousness and self-control (Zhang et al., 2023; Rutberg et al., 2020) facilitate the sustained pursuit of long-term goals despite setbacks and adversity (Dunston et al., 2020; Wolters & Hussain, 2015). Individuals displaying grit can sustain their focus and resolve over extended durations, even when confronted with challenges or failures (Karlen et al., 2019; Newland et al., 2020; Lobo et al., 2024). Regarded as an essential factor in both personal and professional domains, the qualities of grit enhance individuals' ability to confront challenges and overcome obstacles. Longitudinal data indicated that characteristics of grit increasingly predicted performance across several academic outcomes, including retention, educational attainment, and teaching efficacy (Newland et al., 2020; Disabato et al., 2018).

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Physical education, compared to other forms of education, primarily emphasizes the physical aspects of the educational process (Guelmami et al., 2022). Consequently, the assessment of athletes' grit should emphasize their specific educational background and content. Grit has a beneficial impact on athletes, with elevated levels of grit associated with psychological factors including burnout mitigation and perfectionist tendencies (Fawver et al., 2019; Zhang et al., 2023), optimism (Olefir, 2018), immediate positive effects (Rumbold et al., 2022), and diminished physical anxiety (Costello et al., 2022; Oktavia & Viranda, 2024). The resilience in physical education can influence athletes' psychological aspects, athletic performance, and accomplishments in certain sports.

Academic Engagement

Academic engagement, which includes vigour, devotion, and absorption, is acknowledged as a vital determinant of student success and well-being (Schaufeli et al., 2002a; Cadime et al., 2016). Although many studies have investigated the impact of motivation, emotional support, and learning strategies on academic engagement (Longakit et al., 2025; Fredricks et al., 2016; Upadaya & Salmela-Aro, 2013), fewer have investigated the contribution of grit cultivated through physical education and sports training, particularly in combat sports (Lee et al., 2021; Tannoubi et al., 2023). Recent studies indicate that student-athletes may cultivate improved resilience, goal orientation, and focus through participation in sports, potentially fostering more engagement in academic environments (Lozano-Jiménez et al., 2021; Kim, 2019).

Numerous studies have highlighted the connection between school engagement and enhanced learning outcomes (Fredricks et al., 2016), increased academic performance (Engels et al., 2021), decreased dropout rates (Schaufeli et al., 2002a), improved emotional well-being (Schaufeli, 2017), and the cultivation of vital life skills, including resilience and self-regulation (Longakit, Lobo, et al., 2025; Carmona-Halty et al., 2019; Schaufeli, 2017). Moreover, involvement has been associated with elevated motivation levels and an enhanced sense of belonging in educational settings (Longakit et al., 2024; Upadaya & Salmela-Aro, 2013; Schaufeli, 2017). Vigor denotes students' energy and passion towards their academic pursuits (Schaufeli et al., 2002b; Schaufeli, 2017). A student who continuously participates in class discussions and approaches work with determination demonstrates vitality (Roorda et al., 2017). On the other hand, dedication

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is employed to describe a student who engages in their academics with exceptional enthusiasm and concentration (Schaufeli et al., 2002b; Schaufeli, 2017). A student who sets clear academic goals, conducts thorough exam preparation, and strives for success in their classes demonstrates dedication (Hughes & Cao, 2018). Moreover, absorption involves a profound focus on academic endeavors, exemplified by a student being unaware of the passage of time while immersed in a research project or solving complex mathematical problems (Schaufeli et al., 2002b; Schaufeli, 2017). These interrelated aspects jointly promote substantial engagement and enrich a thriving academic experience (Engels et al., 2021). The interplay of multiple facets of academic engagement enhances individual performance outcomes and cultivates a supportive and dynamic learning environment. Research has consistently examined the importance of teacher emotional support (Engels et al., 2020), peer influence (Engels et al., 2020), and academic resilience (Fredricks et al., 2016), in augmenting engagement. Nevertheless, intrinsic motivation, such as grit of combat sport athletes within the realm of physical education are scantily examined.

The current study

Notwithstanding these evidences, the processes by which combat sport training enhances academic engagement remain ambiguous. Most current research examines grit or engagement separately or within a singular context, neglecting to encompass the holistic experience of student-athletes who juggle academic responsibilities alongside intensive physical training (Xu et al., 2022; Datu et al., 2021). Moreover, there is a deficiency of empirical data about the interaction between physical and academic grit and its impact on academic performance in higher education. This study examines the predicted influence of physical education grit (both physical and academic) on academic engagement in combat sport athletes.

The study hypothesizes that both physical and academic grit positively influence academic engagement, offering practical implications for education and physical training programs. Specifically, it answers the following hypothesis:

H_{1a}: Physical Grit significantly predict School Engagement

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H_{1b}: Academic Grit is positively associated with School Engagement

H₁: Physical Education Grit significantly predict School Engagement

Methods

Design and Participants

A total of 496 student martial arts practitioners (338 male and 158 female; $M = 19.45$, $SD = 1.89$) participated in the study. Participants included 124 Taekwondo (25%), 151 Karate-do (30.44%), and 221 Arnis (44.56%) student-athletes enrolled in various universities and colleges of 3 cities in Region X, Mindanao (Iligan City, Cagayan de Oro City and Bukidnon), Philippines. The sample size was calculated using Cochran's formula for continuous data in large populations, considering a 5% margin of error, a 95% confidence level ($z = 1.96$), and an assumed response distribution of 50%, which is a conservative estimate to ensure adequate sample power. The initial recommended minimum was 384 participants. However, to further ensure the reliability of subgroup analyses and account for possible exclusions or incomplete data, the final sample size was increased to 496. This approach enhances statistical power and generalizability while aligning with ethical and logistical considerations in educational and sports research. For this purpose, random sampling was carried out among combat sports student practitioners who are enrolled in the academic year 2024-2025. Participants was recruited based on the following criteria: (1) at least 3 years of participating different sports tournament, and (2) reached regional to national meet in sports. This research applied descriptive correlational design to determine the association of grit and engagement of combat sports student-athletes. The socio demographic characteristics of participants are shown in Table 1.

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Table 1. Sociodemographic profile of the participants

Variables		N (%)	M ± SD	Range
Sex	Male	338 (68%)	19.45 ± .89	18-23
	Female	158 (32%)		
Age				
Type of Combat Sports	Taekwondo	124 (25%)		
	Karate-do	151 (30.44%)		
	Arnis	221 (44.56%)		
Level of Sports Participation	Regional level	315 (63.51%)		
	National level	181 (36.49%)		
Socio-economic status	Low income (PHP 9,520 to PHP 21,194)	195 (39.31%)		
	Low-middle income (21,194 and 43,828)	221 (44.56%)		
	Upper-middle income (PHP 76,669 to PHP 131,484)	80 (16.13%)		

Instruments

The school engagement of college students was measured using Utrecht Work Engagement Scale (UWES-9; Schaufeli et al., 2002). This is a 9-item tool that was established to ascertain engagement level of students and has three factors: vigor (e.g., “When I get up in the morning, I feel like going to class), dedication (e.g., “My studies inspire me”), and absorption (e.g., “I am immersed in my studies”). On a 6-point Likert scale ranging from 0 (never) to 6 (always/every day), respondents were asked to indicate their level of engagement. A higher score indicates greater work engagement. This scale has been used in several studies and has proven to be a reliable and valid instrument (Carmona-Halty et al., 2019; Domínguez-Salas et al., 2022). The overall UWES-9 demonstrates a Cronbach’s alpha of 0.93, with its subscales varying between 0.79 (vigor), .89 (dedication), and 0.84 (absorption).

The academic grit of student was measured using PE-GRIT (Guelmami et al., 2022). PE-GRIT is made up of 16-items and has two factors: Physical Grit (e.g., Intense physical exercise never discourages me) and Academic Grit (e.g., I finish my home exercises, no matter how hard they are.). On a 7-point Likert scale ranging from 1

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(strongly disagree) to 7 (strongly agree) with a higher score indicating high level of academic grit. PE-GRIT has been validated in various studies (Rumbold et al., 2022; González-Bernal et al., 2022; Zhang et al., 2023). The overall PE-GRIT demonstrate a high internal consistency with 0.902, with its subscale ranging from .83 (Academic Grit) to .85 (Physical Grit).

Data Collection

Prior to the data collection, permission was obtained from the school officials, and the test administration commenced following the approval of the research ethical review committee of the institution. Consent forms were obtained from the subjects. The questionnaires clearly defined the research's objective and guaranteed the anonymity of participants' responses. Participants carefully completed the questionnaire packet under the supervision of designated researchers. The researchers verified that the participants are qualified combat sports athletes with experience competing at a minimum of the regional or national levels, as outlined by the inclusion criteria. The data collected from this study were quantified based on the items chosen by the respondents. Enumerated additional hazards associated with participation in the online survey include potential threats to data privacy stemming from the digital collecting of replies. In response, stringent data protection protocols were established to safeguard participant information. Participants were apprised of the potential for slight psychological pain from certain inquiries, as well as their entitlement to withdraw from the study or request a debriefing at any moment.

Statistical Analysis

Before conducting any statistical procedures, the raw data collected through the survey instruments were manually reviewed for completeness. The researchers checked for missing responses, duplicate entries, and inconsistencies. Incomplete or invalid questionnaires were excluded from the final dataset. After this initial screening, the data were encoded into SPSS (Statistical Package for the Social Sciences) version 20.0 for analysis. Following data entry, a data cleaning process was carried out to ensure accuracy and reliability. This included verifying variable coding, inspecting frequency distributions, and identifying any outliers. Normality checks were conducted using skewness and kurtosis statistics, confirming that the data met the acceptable thresholds

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(± 2), allowing for parametric statistical testing. Reliability of the scales was assessed using Cronbach's alpha, confirming internal consistency across all subscales. Descriptive statistics (means and standard deviations) were generated to summarize participant responses. Pearson's bivariate correlation analysis was then used to examine the relationships among the key study variables. Finally, multiple linear regression was employed to determine the predictive influence of physical and academic grit on academic engagement. All statistical tests were performed with a significance level set at $p < .05$, and the assumptions for each analysis were verified prior to interpretation

Results

The table 2 presents the mean, standard deviations, normality estimates, internal reliability, and bivariate correlations among the constructs. The results demonstrated that the factors of academic engagement were positive correlated to physical grit ($r = .289$ to $.412$) and academic grit ($r = .144$ to $.368$). Moreover, the skewness and kurtosis values are relatively close to zero, indicating that the data are approximately normal and suitable for parametric statistical analyses.

Table 2. Bivariate correlation among variables

Variable	1	2	3	4	5	6	7
1. Vigor	(.79)						
2. Dedication	.748**	(.89)					
3. Absorption	.729**	.773**	(.84)				
4. PI	.344**	.320**	.289**	(.76)			
5. PE	.393**	.412**	.364**	.835**	(.74)		
6. AI	.144**	.229**	.148**	.228**	.298**	(.78)	
7. AE	.356**	.368**	.317**	.826**	.823**	.319**	(.73)
M	10.66	11.74	10.90	21.25	21.38	19.10	21.48
SD	2.23	2.27	2.41	4.14	4.13	3.24	3.91
Skewness	.088	-.467	-.219	-.703	-.772	-.178	-.775
Kurtosis	.029	.508	.178	.996	1.182	.525	1.569

Legend: PI- physical interest; PE- physical effort; AI- academic interest; AE- academic effort

Note: Significant at level ** $p < .01$

Table 3 showed the results of multiple regression analyses, testing the hypothesis regarding the predictive association of physical and academic grit on academic engagement. The findings confirm that both physical grit ($\beta = 0.328$, $t = 9.883$, $p < .001$) and academic grit ($\beta = 0.242$, $t = 9.484$, $p < .001$) significantly predict academic engagement, with 16.5% and 15.4% of the variance explained, respectively. Thus, H_{1a}

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and H_{1b} are accepted. Additionally, the overall grit construct also significantly predicts school engagement [$F (1,495) = 97.312$, $p = <.001$] with 14.4% variance explained. These results emphasize that consistency of interest and perseverance of effort developed through physical and academic grit are essential in enhancing academic engagement. The combat sport athletes who demonstrate persistence in physical training and academic tasks are more likely to be highly engaged in their academics. Thus, H_1 is accepted.

Table 3. Multiple Regression results and Hypothesis testing

Hypothesis	Regression weights	Beta	R ²	F	t-value	p-value	Decision
H _{1a}	PG → AE	.328	.165	-	9.883	.001	Accepted
H _{1b}	AG → AE	.242	.154	-	9.484	.001	Accepted
H ₁	Grit → AE	.144	.165	97.312	-	.001	Accepted

Note: PG- Physical Grit; AG- Academic Grit; AE- Academic engagement

Discussion

This study aimed to examine the physical education grit (e.g., physical & academic grit) of combat sport athletes and how these mechanisms are associated with their engagement in academics. Initially, physical grit significantly influences the academic engagement of combat sport athletes. This indicates that the dedication and resilience gained via consistent physical training transcend to their academic endeavors. A martial artist who persistently trains despite physical exhaustion or obstacles exemplifies a commitment to long-term objectives that parallels the effort necessary for academic excellence (Von Culin et al., 2014; Hadiana et al., 2022; Xu et al., 2022). Such students may exhibit a greater propensity to maintain concentration on their studies, submit assignments punctually, or prepare diligently for examinations, despite encountering distractions or obstacles (Lozano-Jiménez et al., 2021; Cao and Lyu, 2024; Chen, 2024). The disciplined practices and psychological resilience cultivated in combat sports establish a basis for coping with academic stress and sustaining motivation amid academic challenges (Xu et al., 2022; Duckworth & Gross, 2014). The findings suggest that incorporating combat sports programs into educational systems can improve students' capacity to endure academic challenges (Duckworth & Gross, 2014). Educators should underscore this relationship by including introspective exercises that enable students to

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acknowledge the applicability of their physical resilience to academic settings. Furthermore, the physical resilience developed via combat sports may exemplify a framework for imparting life skills, like goal-setting, emotional management, and perseverance, which are vital for success beyond the educational environment.

Additionally, the findings demonstrate that academic grit substantially affects the academic engagement of combat sport athletes, highlighting the significance of perseverance and interest in attaining long-term academic goals. Combat sport athletes demonstrating significant academic grit often transfer the persistence and focus cultivated during training to their academic pursuits (Von Culin et al., 2014; Lozano-Jiménez et al., 2021). For instance, a student who commits to mastering a complex combat sports technique, despite numerous setbacks, is likely to tackle challenging academic problems with comparable resilience (Lozano-Jiménez et al., 2021; Xu et al., 2022; Cao and Lyu, 2024). This capacity to sustain work and interest over time allows them to excel in completing large studies or preparing for demanding academic related task (Von Culin et al., 2014; Wang et al., 2021). The findings indicate that cultivating academic grit in combat sport athletes boosts their academic engagement and equips them for future difficulties in both academic and professional arenas. Educational institutions and instructors can leverage this by including goal-setting and reflective activities into combative sports curricula to strengthen the association between perseverance and academic achievement. Furthermore, these programs may exemplify a framework for other extracurricular activities, demonstrating how the development of persistence and drive in one area can profoundly influence several aspects of a student's life.

Lastly, findings reveal a positive influence of physical education grit on academic engagement of combat sport athletes. This underscores that the consistency of interest and perseverance of effort developed through combat sports practice extend beyond the physical domain and positively influence students' academic behaviors. Similar studies have found that student-athletes who learns to master complex techniques or achieve consistent progress in training often applies similar persistence to academic tasks (Lozano-Jiménez et al., 2021; Duckworth & Gross, 2014). Moreover, the ability to remain focused under pressure can also enhance concentration during academics related tasks while completing challenging courses (Von Culin et al., 2014; Xu et al., 2022; Kim,

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2019). This suggests that integrating combat sports into physical education curricula may function as a dual-purpose intervention, enhancing physical fitness and fostering vital life skills, including grit and resilience. Numerous studies have emphasized the advantages of physical education programs in fostering self-regulation (Lozano-Jiménez et al., 2021), goal-setting (Tannoubi et al., 2023), and emotional control (Kim, 2019), which are transferable to academic settings. Moreover, studies have highlighted that physical education grit enhances academic engagement through several interconnected mechanism that bridge the physical and academic domains (Rutberg et al., 2020; Tannoubi et al., 2023; Lee et al., 2021). The self-discipline and perseverance developed via regular physical exercise empower students to tackle intellectual work with same dedication, facilitating effective time management and sustained attention on their academics (Muenks et al., 2018; Tannoubi et al., 2023). Furthermore, the resilience developed via surmounting physical challenges, such as mastering a combat sports technique or surviving rigorous training sessions, prepares students to confront intellectual obstacles with determination and perseverance (Tannoubi et al., 2023; Lee et al., 2021; Newland et al., 2020). Ultimately, the concentration and focus cultivated through combat sports and other physical education pursuits enhance students' attention control, allowing them to maintain engagement during academic endeavors (Lee et al., 2021; Tannoubi et al., 2023). These methods collectively underscore how physical education grit not only fosters physical development but also substantially enhances students' academic engagement and overall achievement. These results support the formulation of comprehensive educational programs that utilize the interaction between physical and cognitive development. Policymakers and educators should contemplate how combat sports programs could focus on at-risk or disengaged children, utilizing the organized discipline of combat sports as a means to re-engage them intellectually. Future research may investigate the long-term effects of these interventions and evaluate how various combat sports disciplines distinctly foster the cultivation of academic grit and engagement. Educational institutions could utilize this by providing organized combat sports classes to develop students' physical and academic resilience. Additionally, educators and policymakers should evaluate how these initiatives can advance overarching educational objectives, including the promotion of a growth mindset and enhancement of long-term academic performance.

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These insights also promote future study to investigate how other physical activities may similarly cultivate qualities that enhance academic achievement.

Limitations and future research

Although the present study offers novel insights into the ways in which the nature of physical education grit influences the academic engagement of student martial art practitioners, it is essential to acknowledge its limitations. First, cross-sectional design limits the capacity to establish causal relationships between grit and academic engagement. Despite the identification of substantial relationships, longitudinal or experimental research are required to ascertain the directionality and enduring impacts of grit on academic engagement. Secondly, the study focused on self-report questionnaires, which may be susceptible to social desirability bias or mistakes in participants' self-evaluation. Subsequent study may use observational techniques or external assessments to improve the objectivity of the results. The study exhibits an acceptable level of internal validity, employing validated instruments (PE-GRIT and UWES-9), uniform data collection protocols, and suitable statistical techniques to analyze the interrelations among variables. The researchers guaranteed data quality by implementing thorough sampling, conducting manual reviews of replies, and employing standardized techniques for instrument administration. The external validity of the findings is constrained by the sampling setting. Participants were only selected from combat sports athletes attending college and universities in 3 cities in Region X, Mindanao, Philippines. Consequently, the generalizability to other populations—such as athletes from non-combat sports, private institutions, or diverse cultural or educational contexts—should be undertaken with prudence. Future research may incorporate cross-regional samples or comparative designs across various sports to enhance applicability. Fourth, contextual factors including academic workload, institutional support, and personal motivation were not accounted for and may have affected participants' degrees of grit or involvement. Incorporating these variables into future models may yield a more thorough comprehension of the underlying dynamics. Finally, although the study examined both physical and academic grit, it did not investigate qualitative aspects, such as personal narratives or motivating methods, which could provide more profound insights into how

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combat sports training influences student behavior and academic perseverance. Addressing these limitations in subsequent research could enhance the comprehension of the relationship between grit, physical education, and academic success across varied educational settings.

Conclusion

This study highlights that both physical and academic grit significantly contribute to academic engagement among combat sports student-athletes. Students who show persistence and discipline in their physical training are also more likely to stay focused, motivated, and involved in their academic work. This suggests that the skills developed in combat sports, such as perseverance and self-control, can support success in school. These findings have significant practical implications for educators, athletic coaches, and educational institutions. The significant influence of both physical and academic grit on academic engagement indicates that combat sports training could function as an effective dual-purpose intervention, enhancing physical fitness while simultaneously cultivating essential psychological attributes that foster academic achievement. By deliberately structuring physical education programs that prioritize goal-setting, tenacity, and emotional regulation, schools may cultivate life skills that transcend athletics and permeate the academic domain. These results are especially pertinent for universities pursuing comprehensive strategies for student development, particularly for groups managing demanding athletic and academic obligations.

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