

Attention Control and Emotional Regulation Among Long-Term Adolescent Taekwondo Practitioners With and Without ADHD: An Exploratory Mixed-Methods Study

Tomer Barnoon
tomerbarnoon12@gmail.com

ABSTRACT

Most existing research on martial arts and ADHD measures cognitive test scores in children, leaving out important details of how adolescents themselves experience the training. Previous studies rarely examine emotional regulation as its own outcome. Therefore, the current exploratory mixed-methods study explored self-reported attention control, emotional regulation, and self-control in long-term adolescent Taekwondo practitioners with and without self-reported ADHD diagnoses, and which facets of training participants believed were relevant to these capacities. Ten adolescent Taekwondo practitioners aged 14 to 18 (five ADHD, five non-ADHD) participated in the survey, while three additional practitioners took part in semi-structured interviews. Overall, the participants reported high self-regulation across all three domains. Participants with ADHD reported significantly higher attention control than participants without ADHD. However, in this small sample, the attention composite exhibited low internal consistency, and this should not be interpreted as evidence that participants with ADHD had objectively better attention or that Taekwondo improved attention. Emotional regulation did not significantly differ between groups, and the study was insufficient to detect a group difference in the domain. The number of years of training showed little or no correlation with the outcomes, suggesting no evidence of a dose-response relationship. Interviews pointed to features of training that participants perceived as helpful, including Poomsae and high-stakes sparring. Because the design was cross-sectional, involved a small sample of long-term practitioners, used study-specific self-report measures, and did not include any baseline or non-Taekwondo comparison group, the results should be considered descriptive and hypothesis-generating, rather than evidence of therapeutic efficacy.

INTRODUCTION

Attention-Deficit/Hyperactivity Disorder (ADHD) affects approximately 5 to 7% of children and adolescents worldwide, making it one of the most prevalent neurodevelopmental conditions today (Polanczyk et al., 2015). Pharmacological and behavioral treatments are available, but still a significant

Sep 2026
Vol 11. No 4.

number of adolescents continue to struggle with attention, impulsivity, and emotional dysregulation in their day-to-day lives even with access to these treatments (Bunford et al., 2015; Christiansen et al., 2019). Medication and Cognitive Behavioral Therapy (CBT) still remain among the most prominently used interventions for ADHD even though they do not, by themselves, sufficiently address all of the possible variations of symptoms for individuals, which strongly highlights the need for alternative or complementary approaches (Chan et al., 2016; De Crescenzo et al., 2017). As researchers are searching for non-pharmacological interventions, structured physical practices such as martial arts, including Taekwondo, have begun to attract growing attention. However, the relationship between long-term participation in Taekwondo and self-regulation in adolescents with ADHD is relatively under-explored.

Adolescents with ADHD often have deficits in executive functioning and self-regulatory capacity, which in most cases causes a struggle to regulate attention and emotion. A study showed that structured discipline-based physical training may repeatedly engage capacities relevant to these difficulties by demanding focused behavior under conditions of physical and emotional stress (Sucholbiak et al., 2025). For example, Taekwondo is built around principles that appear directly relevant to the core challenges faced by adolescents with ADHD, including sustained concentration, repetitive skill practice, and managing frustration and pressure (Lakes & Hoyt, 2004). Unlike general physical exercise, Taekwondo training incorporates explicit demands for self-discipline, emotional control, and focused attention within every session, which suggests that it can serve as a structured context for repeated practice of attention, behavioral inhibition, and emotional control (Sucholbiak et al., 2025).

In this way, Taekwondo is different from many forms of general physical activity in that it repeatedly requires sustained attention, behavioral control, and emotional composure in a highly structured setting (Lakes & Hoyt, 2004). Researchers have already begun to document the cognitive benefits of physical exercise for children with ADHD, with some studies showing improvements in executive function, attention, and inhibitory control following aerobic activity (Sun et al., 2022; Xie et al., 2021). A smaller body of work has specifically examined martial arts training, finding preliminary associations with improved self-control and reduced behavioral problems in children with attention difficulties (Kadri et al., 2019; Lakes & Hoyt, 2004).

This paper extends that framework to long-term Taekwondo training in adolescents, a population and training duration that remains largely understudied. Most existing research has focused on short-term interventions, young children rather than teens, or martial arts broadly rather than Taekwondo as its own discipline. The studies that do exist often compound these issues with small sample sizes or by trying to examine Taekwondo-inspired programs rather than traditional practice. So the question of what sustained and authentic Taekwondo training does for adolescents with ADHD has not yet been examined.

The conceptual gaps are just as significant. Prior work has leaned heavily on cognitive tests and executive function measures while treating attention control and emotional regulation as the same thing. Researchers have also rarely compared practitioners with and without ADHD, which limits what conclusions can actually be drawn. Additionally, research relies on parent reports rather than adolescents' reports. Because of this absence, little is known about how practitioners themselves understand the

mechanisms at work, whether it's the discipline, the repetition, the instructor relationship, and how those mechanisms shape self-regulation.

To address these gaps that are seen in previous literature, this study examines long-term Taekwondo training as a distinct and structured intervention rather than just generalizing across martial arts or short-term programs. This gives the ability to assess its relationship by highlighting attention control and emotional regulation. It first reviews the existing literature on ADHD in adolescence, current intervention approaches, and the growing evidence base for physical activity and martial arts as complementary strategies for attention and emotional regulation. It then examines the specific structural and philosophical features of Taekwondo training that may be relevant to self-regulation among adolescents with ADHD. Finally, it synthesizes these bodies of literature alongside original mixed-methods data, combining self-report survey findings with qualitative interview responses in order to understand how long-term Taekwondo training relates to attention control and emotional regulation and also to identify which ways of practice adolescents themselves find most beneficial. Specifically, this study sets out to answer the following three core research questions:

- **RQ1:** How does long-term Taekwondo training relate to attention control and emotional regulation in adolescents with ADHD?
- **RQ2:** How do attention and emotional regulation patterns differ between Taekwondo practitioners with and without ADHD?
- **RQ3:** Which aspects of Taekwondo training (e.g., discipline, repetition, instructor feedback) are perceived as most beneficial for focus and emotional control?

LITERATURE REVIEW

ADHD is a neurodevelopmental disorder whose symptoms commonly include persistent difficulties in attention regulation, impulse control, and emotional self-regulation. In fact, emotional dysregulation has increasingly been recognized as a primary symptom of ADHD rather than a secondary feature (Hirsch et al., 2018). During adolescence, these symptoms can significantly disrupt academic performance, social relationships, and overall well-being (Wehmeier et al., 2010), making attention control, impulse regulation, and emotional dysregulation central concerns when examining adolescents with ADHD (Christiansen et al., 2019). Because ADHD is characterized by constant developmental changes in symptom expression, adolescence particularly is a critical developmental stage (Hurtig et al., 2007). Rather than diminishing with age, these core symptoms can often be more difficult to manage and create major challenges for teenagers trying to balance their social and academic lives (Willoughby, 2003). Diagnosing the disorder during this time is also complicated by the fact that self-report data can be inaccurate, which points to a strong need for testing models that look at the fuller picture of adolescent symptoms, especially emotional regulation (Sibley et al., 2012).

ADHD extends beyond just attention deficits, as it involves deep challenges with emotional regulation (Christiansen et al., 2019). To understand what adolescents with ADHD experience, research should go

beyond attention spans and explore how attention and emotion can possibly interact together. Symptoms are not completely stable over time, and inattention usually persists straight through the teenage years (Hurtig et al., 2007); even though emotional dysregulation is a huge part of adolescent ADHD, it remains understudied. Issues with impulsive reactions and anger management severely hurt students' school life and friendships (Wehmeier et al., 2010). In fact, emotional dysregulation is one of the strongest links to peer rejection, functional impairment, and risky behaviors (Bunford et al., 2015).

Currently, most standard treatments for ADHD rely heavily on medication and psychosocial therapy (Nazarova et al., 2022; Young & Amarasinghe, 2010). Stimulant medications for ADHD are proven to reduce core ADHD symptoms, but they do often come with side effects and concerns about long-term dependence (De Crescenzo et al., 2017). Psychosocial therapies can help as well, but they can be fairly hard to access and are sometimes less effective than medication (Antshel & Barkley, 2008). Adding on, a major issue is that these current pharmacological and behavioral treatments do not consistently target emotional dysregulation as a main goal (Chan et al., 2016). Because of these limitations, existing treatments might not be enough to handle the complex nature of adolescent ADHD on their own, especially when it comes to persistent emotional struggles.

Because standard treatments have these gaps, researchers are finding growing evidence that physical activity, and martial arts in particular, like Taekwondo, can be effective as a complementary intervention. General physical exercise is already broadly linked to better cognitive and behavioral functioning (Nakonechnyi & Galan, 2017; Sun et al., 2022; Vysniauske et al., 2020; Xie et al., 2021). Martial arts disciplines like Taekwondo take this a step further by emphasizing these structured rules, sustained focus, repetition, and keeping emotions in check under pressure (Lakes & Hoyt, 2004). Since these types of sports require constant time and discipline, they tend to directly train the brain's executive functioning pathways responsible for self-regulation (Lakes & Hoyt, 2004; Suchołbiak et al., 2025). This makes them naturally more suited to target core ADHD symptoms and general reviews of martial arts interventions, which have been seen to show strong links to improved impulse control and behavioral regulation (Suchołbiak et al., 2025).

When looking specifically at long-term Taekwondo training, there is emerging evidence of real cognitive benefits for youths with ADHD. For example, an 18-month Taekwondo program study was found to improve adolescents' selective attention, processing speed, and inhibitory control (Kadri et al., 2019). Another study looked more closely at Poomsae (memorized forms in Taekwondo) and found unique improvements in working memory, cognitive flexibility, and self-control (Kadri, 2021). Putting these findings together, it seems that while general Taekwondo practice helps with overall attention, the complex movement sequencing that is required to memorize forms more specifically builds cognitive adaptability for practitioners. Alongside the quantitative data, a study of a Taekwondo-inspired program for children with ADHD found that some parents reported improvements in their children's attention and better social functioning (Shraim, 2024). Notably, this evidence came from an adapted program with younger children and relied on parents' observations rather than the participants' own perspectives. But despite such promising evidence, there remains a critical need for research that moves beyond the quantitative metrics and parent observations used to explore the authentic, lived experiences of

adolescents engaging in long-term, traditional Taekwondo.

METHODOLOGY

Research Design

This study utilized an exploratory mixed-methods design to evaluate the association between long-term Taekwondo training and its behavioral outcomes in adolescents. The design of this study consisted of integrating survey-based quantitative data to find numerical trends alongside semi-structured qualitative interviews to capture individual lived experiences. Because the design is cross-sectional, with all data collected at a single point in time and no baseline measurements taken before participants began training, this study should be viewed as strictly exploratory and as examining relationships and patterns rather than establishing direct causal connections.

By integrating the quantitative survey data with the qualitative interview responses, this study was able to capture both measurable behavioral patterns and subjective experiences of adolescent practitioners. This offers a more complete and developmentally grounded picture of how Taekwondo may function as a complementary approach to ADHD management.

Participants

In this study, a total of 11 adolescent Taekwondo practitioners were initially recruited using snowball sampling through a local Dojang's WhatsApp group chat and personal school networks. After data collection, one of the survey results showed that one of the non-ADHD participants provided highly contradictory responses across reverse-coded items on the Likert scale. Out of the 17 items, 4 items (Q5, Q11, Q12, and Q15) were reverse-coded, and the excluded participant gave contradictory answers on all four of these. Hence, this participant's data were excluded to preserve the dataset's reliability for analysis. Therefore, the final sample for the survey consisted of 10 adolescents aged 14 to 18 years old. The sample was evenly divided into five participants who had a self-reported ADHD diagnosis and five who did not. Participants without ADHD served as a comparison group. Since both groups consisted exclusively of long-term Taekwondo practitioners, this group should not be interpreted as a no-treatment or non-Taekwondo control group. To meet the criteria for filling out the survey, each participant was required to be actively practicing Taekwondo and to have been training continuously for a minimum of one year. Separately, three other adolescent practitioners were recruited from the same Taekwondo networks for the interviews. These three did not fill out the survey, so the survey and interview samples do not overlap. This means interview responses cannot be matched to any individual's survey scores. In total, 13 participants took part across both parts of the study.

The two survey groups were very similar in the background information collected. The average age was 16.0 years in both groups (ADHD SD = 0.71, ages 15–17; non-ADHD SD = 1.58, ages 14–18), and the average training length was also 9.0 years in both (ADHD SD = 3.08, range 5–13; non-ADHD SD = 1.87, range 7–12). Weekly training was a little higher for the ADHD group at 3.4 sessions compared to 2.8, but this difference was not significant, $t(8) = 1.90$, $p = .094$. Because the groups matched on age and training

length, those two factors are unlikely to explain the differences that were reported later. Participant gender was not asked about on the form, so it could not be checked as a factor.

ADHD status for participants was based on a self-report question on the survey, which asked participants whether they had an ADHD diagnosis (Yes/No). Participants in the ADHD group who said they had been diagnosed, but no documentation was asked for or checked to verify, and no standardized ADHD rating scale was used in this study. Group assignment was based on what participants reported about themselves rather than a diagnosis confirmed by the researcher.

Materials and Instruments

Quantitative Data: For the quantitative analysis, the primary data were gathered through a digital questionnaire that was conducted using Google Forms. The survey first asked for background information of the participants, including participants' age, Taekwondo training frequency, years of continuous practice of Taekwondo, and ADHD status. The survey then included 17 questions, which were randomized and were set to be evaluated on a 5-point Likert scale (1 = *Strongly Disagree*, 5 = *Strongly Agree*). The items were purposefully designed to measure participants on three ideas:

- *Attention Control:* The survey questions included statements like *"I find it easy to stay focused throughout training"* and reverse-coded statements like *"I get distracted during Taekwondo practice."*
- *Emotional Regulation:* Some questions evaluated the management of affect, such as statements like *"I stay calm when I make mistakes in Taekwondo"* and reverse-coded prompts such as *"I get frustrated easily during practice."*
- *Impulsivity / Self-Control:* Questions for behavioral inhibition were checked using statements like *"I can control my body and stay still when required during training."*

The survey items were developed specifically for this study rather than adapted from an existing validated instrument. The three constructs were chosen because prior research identifies attention regulation, emotional regulation, and impulse control as the symptom domains most central to adolescent ADHD (Bunford et al., 2015; Christiansen et al., 2019; Hirsch et al., 2018). Items were written to follow standard survey-design principles: each item measured a single idea, and wording was kept simple and age-appropriate rather than clinical. The questionnaire was not adapted from a psychometrically validated instrument but was developed specifically for this exploratory study. Most items addressed participants' present experiences of attention, emotional regulation, or behavioral control in contexts related to Taekwondo. However, one item in each domain specifically asked participants to assess whether Taekwondo had improved or helped their functioning outside of training. Therefore, these items assess perceived benefit or transfer rather than the construct itself and are subject to expectancy or demand effects. Such a distinction is relevant in the interpretation of the composite scores. Four items were reverse-coded so that inconsistent or automatic responding could be detected. Item order was randomized so that participants would not see the three constructs as separate blocks. Before full distribution, the survey was reviewed and revised multiple times. Because the instrument was purpose-built for this

Taekwondo-specific context, it has not undergone independent validation, which limits how far these scores can be compared to those produced by established measures.

Internal consistency was calculated for each of the three composite scores. Cronbach's alpha was .65 for Emotional Regulation, .24 for Attention Control, and $-.06$ for Impulsivity/Self-Control. Only the Emotional Regulation scale approached an acceptable level, while the other two fell below conventional thresholds. Two points are worth noting. First, alpha is highly unstable when estimated from only 10 respondents, so these values carry wide uncertainty and should not be read as precise reliability estimates. The low internal consistency suggests that these item sets should not be considered well-validated unidimensional scales. Therefore, inferential comparisons involving these composites are presented only as exploratory patterns in this sample. A statistically significant group comparison cannot overcome this measurement limitation. The attention result in particular should not be interpreted as evidence of objectively superior attentional ability.

Second, the low values likely reflect the fact that several items asked about different contexts, such as focusing during a Taekwondo class compared to focusing at school, which participants may reasonably answer differently. For these reasons, the composite scores in this study are treated as rough indicators of self-perceived self-regulation rather than as psychometrically validated scales, and the results are interpreted with that in mind. These reliability values apply only to the survey composites and do not affect the interview data, which was analyzed thematically rather than scored, so the qualitative findings do not depend on the psychometric properties of the questionnaire.

Qualitative Data: Semi-structured interview questions were designed and conducted to capture the subjective experiences regarding focus, self-control, and emotional management in participants. The interviews were recorded using a built-in feature in an iPhone that provides an instant transcription tool. The prompts were also standardized to guarantee structural consistency among the interviewees. The interviews included questions like *"Have you noticed any changes in how you handle anger or frustration (or anxiety) since starting Taekwondo?"* and *"Which parts of Taekwondo training help you the most with self-control? Why?"*

Procedure

The Google Forms survey link was distributed to group chats that involved active Taekwondo practitioners, with a comprehensive introduction that detailed the study's focus on academic research and its guarantee of anonymity. Also, the completion and electronic submission of the form constituted active participant assent and informed consent.

For the interviews, participants were requested to volunteer for an interview through various local Taekwondo group chats. For those who consented, a brief phone call was scheduled. The privacy of the interview itself was verbally stated before starting to record the call. The interviews, on average, lasted approximately five minutes.

Data Analysis

The survey data was organized into a structural matrix and analyzed when fed into a custom script written in Python. The data analysis began with programming a reverse-scoring algorithm for items Q5, Q11, Q12, and Q15. The script used math Python libraries and statistics to calculate group means, standard deviations, maximums, and minimums in order to outline overall data trends. Independent-samples t-tests were also executed to evaluate any variations in mean attention and emotional regulation scores between the ADHD group and the non-ADHD group. Additionally, Cohen's d was calculated alongside each test so that the size of each difference could be reported rather than only its statistical significance, and 95% confidence intervals were calculated for each group difference.

Independent-samples t-tests were selected because the design compares two independent groups on a continuous composite score, which is the situation the test is built for. However, with only five participants per group, the assumption of normality cannot be meaningfully tested, and the test may be sensitive to departures from it. To check whether the results depended on that assumption, each group comparison was repeated using an exact permutation test, which makes no distributional assumption and instead compares the observed group difference against every one of the 252 possible ways that 10 participants can be split into two groups of five. Both sets of the results are reported below. Finally, a correlation analysis was conducted to determine whether a relationship existed between a practitioner's total years of Taekwondo training and their self-reported focus and emotional control scores.

Before analysis, automatically generated transcripts were manually checked and corrected against the recordings. Given the small sample size of interviews ($n = 3$), the qualitative component was not designed to reach thematic saturation but rather was descriptive and exploratory. The finalized transcripts were then analyzed using manual thematic coding, where different themes were grouped using different highlighted colors. The grouping highlighted six different thematic topics relevant to the research questions, which were identified from the transcripts and were categorized based on their text segments. Segments that had to do with *Focus & Attention* were Red, *Emotional Regulation* (Orange), *Self-Control/Impulsivity* (Yellow), *Characteristics of Taekwondo* (Green), *Discipline* (Light Blue), and *Enjoyment/Motivation* (Purple). The participants were then reviewed across these categories to identify common ways practitioners described the connection between Taekwondo and self-regulation.

Ethical Considerations

To ensure safety and to ethically protect all the human participants, the study adhered to strict identity confidentiality and data security. All of the quantitative data collection was conducted completely anonymously, with no identifying markers about participants being requested on the Google Forms. All audio files that were collected from the phone interviews were safely stored and then deleted on a secure, password-protected local device that was used for correcting transcript typos and anonymized before the thematic coding process took place. Because all participants were minors, parental consent was obtained in addition to participant assent before any data collection took place. The study also received IRB approval prior to recruitment, following the ISEF guidelines, with the research plan reviewed and approved by an educator, a school administrator, and a health professional.

RESULTS

Quantitative Findings

Overall, the survey data showed a very high baseline of self-reported behavioral control among the adolescent practitioners (Table 1, Figure 1). Out of the 10 participants, the average attention control score reached 4.33 out of 5 ($SD = 0.39$), the impulsivity and self-control score reached 4.37 ($SD = 0.27$), and the emotional regulation score averaged 4.07 ($SD = 0.44$). The relatively small standard deviations indicate that participants responded fairly consistently, without extreme outliers. On average, the practitioners who responded to the survey had 9 years of continuous Taekwondo training ($SD = 2.40$) and practiced around three days a week, so this sample consisted of experienced practitioners rather than beginners.

To examine whether ADHD status was what drove these scores, independent-samples t-tests compared the ADHD group to the non-ADHD control group. The calculations showed a statistically significant difference in attention control between the two sets of students, $t(8) = 5.10$, $p = .001$, $d = 3.22$, 95% CI [0.36, 0.94]. The exact permutation test produced the same conclusion, $p = .008$. Because the p -value fell below the standard .05 cutoff, it shows that there is a difference in how these two groups experience focus when practicing Taekwondo. This finding, however, should be cautiously interpreted due to the small group sizes ($n = 5$ per group). Effect sizes estimated from samples at this small size are unstable and are likely inflated relative to what a larger sample would produce. So this result should be treated as preliminary, requiring replication rather than as an established difference. When evaluating emotional regulation, the t-test failed to reach statistical significance, $t(8) = 1.91$, $p = .092$, and the confidence interval for this difference includes zero ($d = 1.21$, 95% CI [-0.10, 1.03], permutation $p = .135$), so the numerical gap between the groups should not be read as meaningful. Impulsivity and self-control also were not significantly different, $t(8) = 1.73$, $p = .123$, $d = 1.09$, 95% CI [-0.09, 0.62], permutation $p = .198$. A follow-up correlation analysis was conducted to check whether longer training years in Taekwondo naturally led to better focus or if it led to emotional regulation. The correlation between years of training and Attention Control showed a slight positive relationship ($r = .12$), but it cannot be distinguished from no relationship at this sample size, while the link between years of training and Emotional Regulation was zero ($r = .00$).

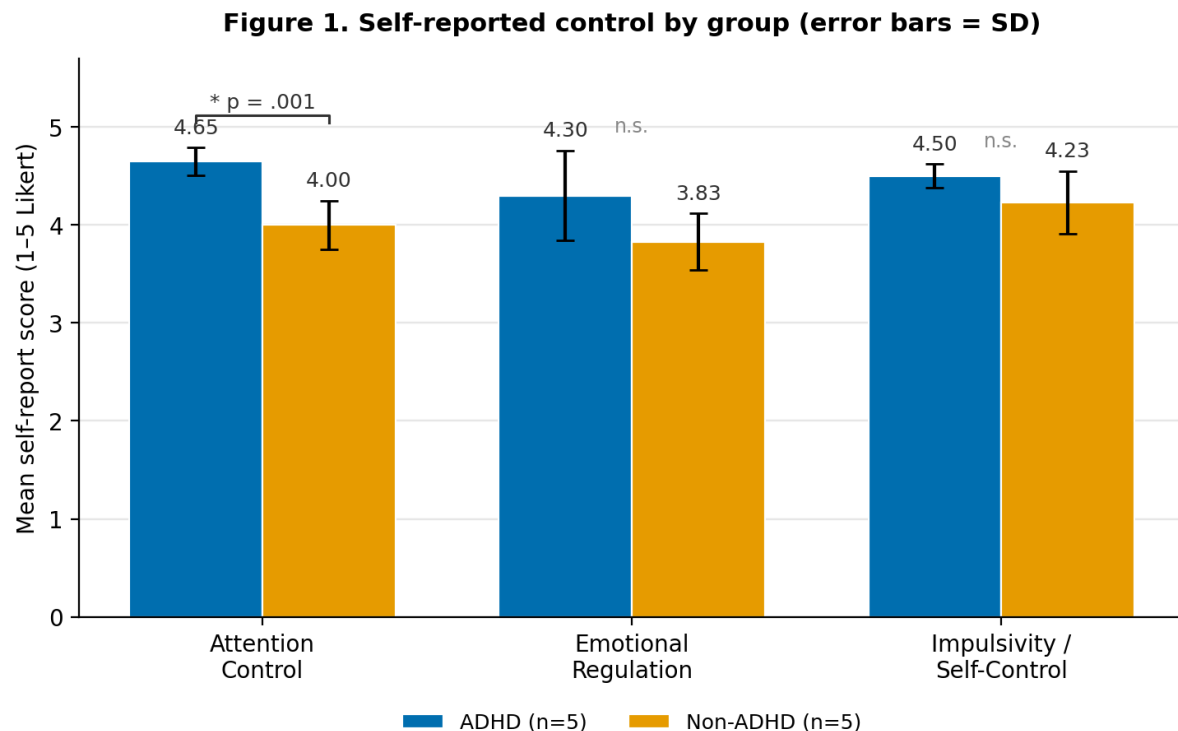
Table 1. Self-reported scores by group, with independent-samples t-tests, effect sizes, and confidence intervals.

Outcome domain	Overall M (SD)	ADHD M (SD)	Non-ADHD M (SD)	t(8)	p	Cohen's d	95% CI of difference	Permutation p
Attention Control	4.33 (0.39)	4.65 (0.14)	4.00 (0.25)	5.10	.001*	3.22	[0.36, 0.94]	.008

Outcome domain	Overall M (SD)	ADHD M (SD)	Non-ADHD M (SD)	t(8)	p	Cohen's d	95% CI of difference	Permutation p
Emotional Regulation	4.07 (0.44)	4.30 (0.46)	3.83 (0.29)	1.91	.092	1.21	[-0.10, 1.03]	.135
Impulsivity / Self-Control	4.37 (0.27)	4.50 (0.12)	4.23 (0.32)	1.73	.123	1.09	[-0.09, 0.62]	.198

Note. N = 10 (5 with ADHD, 5 without). Scores are on a 1–5 Likert scale; higher values indicate greater self-reported control. Cohen's d was calculated using the pooled standard deviation. Confidence intervals are for the difference between group means. Permutation p-values come from an exact test across all 252 possible group splits and require no normality assumption. Effect sizes and confidence intervals estimated from five participants per group are unstable and should be interpreted as preliminary. * $p < .05$. The groups were matched on age (both M = 16.0 years) and years of training (both M = 9.0 years); weekly training frequency was 3.4 sessions in the ADHD group and 2.8 in the non-ADHD group, $t(8) = 1.90$, $p = .094$. Years of training correlated only weakly with attention ($r = .12$) and showed essentially no correlation with emotional regulation ($r = .00$) or impulsivity and self-control ($r = -.09$).

Figure 1. Self-reported control by group



Note. Mean self-reported attention control, emotional regulation, and impulsivity/self-control by group. Error bars represent standard deviations, not standard errors. N = 10 (5 with ADHD, 5 without).

Qualitative Findings

To complement the quantitative results and to explore mechanisms that practitioners themselves deemed relevant to self-regulation, the interview transcripts were analyzed using the above-described descriptive coding approach. The three categories that were identified most frequently were used as the themes below: Emotional Regulation (anger control), Discipline (individual responsibility), and the specific characteristics of Taekwondo that participants treated as coping mechanisms.

Emotional Regulation

Participants repeatedly connected Taekwondo to staying calm in heated moments, both inside and outside the dojang, and several pointed to high-pressure sparring as where that skill was built. As one participant with ADHD put it, *“in situations I was able to keep myself calm... sparring where you have 10 seconds left and everyone’s yelling, you have to just keep your cool and try to finish the match, which also correlates to school where you’re in an argument, it helps you keep your cool.”* A participant without ADHD described the same ability more generally, saying Taekwondo helps *“with controlling your emotions and... not necessarily exploding.”* This theme corresponds at the group level with the relatively high emotional-regulation scores reported by the separate survey sample and shows that these practitioners associate anger management with the sport.

Discipline

The second theme was the structure and personal accountability that Taekwondo builds in. Participants described how the discipline of the dojang carried over into everyday focus and behavior. One explained that having *“a master to guide me and force me into a lifestyle of structure, rigid, everything was by the book... brought balance into the life that could only have been fixed with medicine.”* Others emphasized the individual nature of the sport, contrasting it with team sports where blame can be passed around: *“In other sports, like basketball, I would just get mad at my teammates... while Taekwondo is independent, so it was me working with myself only, and whenever something was wrong, there’s no one to blame other than yourself.”* This offers one possible account of the high self-control scores seen in the survey sample, since interviewees described learning to manage themselves rather than react to others.

Characteristics of Taekwondo

Finally, participants singled out specific elements of training, especially Poomsae and controlled breathing, as tools they consciously use to steady themselves. One described how Poomsae *“is very calming and soothing and it teaches you how to breathe and just try keeping yourself calm with the movements,”* the same way you would try to stay calm in a stressful situation outside of Taekwondo. For participants with more severe ADHD, the sport took on an even larger role: *“Taekwondo is really what made me who I am today, and I really recommend it for people with ADHD and especially people with severe ADHD, like I had... it really just makes you able to do the things a kid with ADHD would want to do... even just sitting at a restaurant with your family.”* These accounts suggest that particular, deliberate techniques within Taekwondo, not just the activity as a whole, are what participants lean on to cope.

During coding, several categories were grouped so that the themes could line up with the survey constructs. Segments that were about Poomsae and controlled breathing were generally put under Self-Control because participants described them as a technique deliberately used to slow themselves down, steady their bodies, and stay grounded, which is exercising self-control over movement and attention.

In the same way, segments about anger control and staying calm during aggravating or high-pressure moments were coded under Emotional Regulation. Because the interview participants are not the same individuals as the survey participants, these themes cannot be matched to any individual's scores, or statistically test the mechanisms suggested by the quantitative findings. Instead, they provide complementary first-person stories of how another group of long-term practitioners understood the roles of discipline, emotional control, poomsae, breathing, and sparring in their own lives.

DISCUSSION

This study set out to explore how long-term Taekwondo training relates to attention control and emotional regulation in adolescents with and without ADHD, using a combination of survey data and interviews. Overall, the participants reported high levels of attention control, emotional regulation, and self-control. The most notable finding was that the ADHD group actually reported significantly higher attention

control than the non-ADHD group, while emotional regulation scores did not significantly differ between groups. The interviews, conducted with a separate group of practitioners, pointed to discipline, individual responsibility, and specific training elements like Poomsae and sparring as being the parts of Taekwondo that participants felt helped them the most. Because the design was cross-sectional with no baseline measurements, the findings below describe associations and perceived benefits rather than evidence that training produced any change.

Regarding RQ1, the results indicated relatively high levels of self-regulation on the study-specific measures for participants with ADHD in this sample. However, the present design is not able to determine if these capacities were produced by Taekwondo, if these capacities were different when compared to adolescents who do not practice Taekwondo, or if adolescents with stronger baseline motivation or self-regulation were more likely to continue Taekwondo long-term. The ADHD participants in this sample reported strong self-regulation skills, which may be connected to the fact that Taekwondo repeatedly trains focus, body control, and emotional control in nearly every session. Interestingly, the number of years of training was only weakly correlated with attention ($r = .12$) and showed no correlation with emotional regulation ($r = .00$). These correlations should not be interpreted as evidence that length of training is unimportant because the sample is very small, and the range is restricted by recruiting only experienced practitioners. Instead, the study did not find a clear dose-response relationship within this sample. However, the interview accounts highlight candidate mechanisms for future testing, such as repeated demands for concentration, controlled breathing, composure during sparring, and instructor-imposed structure.

For RQ2, the comparison that was found between the groups showed an interesting result. The ADHD group reported a comparably higher mean attention control score ($M = 4.65$) than the non-ADHD group ($M = 4.00$), and this difference was statistically significant, $t(8) = 5.10$, $p = .001$. However, this result should be interpreted cautiously and should not be read as ADHD participants having objectively better attention. The Attention Control composite had low internal consistency ($\alpha = .24$), was entirely self-report, and included an item asking participants to rate whether Taekwondo had improved their focus outside training. It cannot therefore be taken as evidence that participants with ADHD had better objective attention.

One possible explanation is based on differences in self-perception or reference point: adolescents with ADHD may be particularly sensitive to perceived changes in a domain in which they have previously had difficulty. However, this explanation was not tested directly in the present study. Participants with ADHD interviewed perceived large changes in their capacity to stay calm or attentive, but these reports should be seen as consistent with this interpretation rather than as direct evidence of it, considering that the interview and survey samples were different.

For emotional regulation, the ADHD group also scored higher (ADHD group: $M = 4.30$ vs. non-ADHD group: $M = 3.83$), but the difference did not reach significance ($p = .092$; *permutation* $p = .135$). This non-significant result does not prove the groups were the same. Instead, the study did not provide enough

evidence to prove a difference. The same caution applies to Impulsivity/Self-Control ($p = .123$; permutation $p = .198$).

For RQ3, the interviews suggested different components of Taekwondo that may support different dimensions of self-regulation. For example, Poomsae was repeatedly described as calming and was said to be connected to controlled breathing, which participants linked to focus and self-control. Another example was how sparring was described as a high-pressure situation where keeping yourself controlled mentally in the final seconds of a match is what they connected to managing emotion under stress. Participants also emphasized multiple times the individual nature of the sport. Unlike team sports, where frustration can be directed at teammates, Taekwondo leaves no one to blame but oneself, which may reduce frustration towards others and build personal accountability and independence instead. Finally, the structured environment and the role of instructors were identified frequently, with one participant explaining that having a master enforce a strict, "by the book" schedule brought a kind of balance that he felt could otherwise only come from medication. These accounts suggest possible Taekwondo-specific mechanisms but do not show that these mechanisms resulted in improvements in self-regulation.

Although the interviews pointed to Taekwondo-specific mechanisms, several alternative explanations cannot be ruled out by this design. The first is general physical activity, since regular aerobic exercise on its own is associated with better attention and behavioral regulation in young people with ADHD (Sun et al., 2022; Vysniauske et al., 2020; Xie et al., 2021), and participants trained roughly three times per week. The second is social support, since the dojang provides consistent contact with instructors and peers, and interviewees specifically credited their instructors. The third is that any structured extracurricular activity with a fixed schedule and clear expectations might produce similar patterns, meaning the structure rather than the martial art could be doing the work. The fourth is personality, since adolescents who stay with a demanding discipline for nine years on average may already be more persistent or motivated than those who do not. Distinguishing between these would require comparing Taekwondo practitioners with adolescents in other structured physical activities, which this study did not do.

These findings connect back to the existing literature in a few meaningful ways. The high attention scores among ADHD practitioners are fairly consistent with the experimental studies reporting that long-term Taekwondo training is linked to selective attention and inhibitory control in youth with ADHD (Kadri et al., 2019; Kadri, 2021), and the themes of discipline and self-regulation reflect earlier work on martial arts and self-control (Lakes & Hoyt, 2004). However, this study adds something that the previous studies did not show: the perspective of the adolescents themselves. Prior research has relied mostly on cognitive tests and parent reports, while our interviews captured how practitioners with ADHD personally understand the mechanisms they associate with their own self-regulation. This first-person perspective, along with the direct comparison between ADHD and non-ADHD practitioners and the explicit focus on emotional regulation, is the main contribution of this study. This is also why the interview material carries particular weight here. Standardized scales can miss what practitioners actually do to manage themselves, and the interviews identified specific mechanisms, such as Poomsae and breathing, composure during sparring, and individual accountability, that no Likert item in this study asked about directly.

At the same time, this study has several limitations that should be acknowledged. First, the small sample size limits the ability to generalize the results and makes the statistical results, especially the significant t-test, less stable. Because the interview sample did not overlap with the survey sample, the qualitative findings cannot be used to explain individual quantitative results. Another limitation is that the ADHD status of participants was self-reported rather than clinically verified. All outcomes were self-reported, and no objective cognitive measures were included, so the study measured perceived rather than demonstrated attention. Selection bias might also exist, since every participant in the sample chose Taekwondo and practiced it for years; adolescents who tried Taekwondo and quit are not represented, which may inflate how beneficial the sport actually appears to be. Additionally, there wasn't a non-Taekwondo control group, nor any longitudinal data, so it is not proven whether these participants would have developed similar self-regulation skills without the sport. Recall bias is a further concern, since interviewees were describing changes across periods extending in some cases beyond a decade. Although several had reflected on their development continuously rather than only at the time of interview, no baseline measurement exists against which those recollections can be checked, and one participant had begun training too young to remember life before it. It is also hard to separate any association from normal maturation during adolescence, since attention and emotional control generally improve with age regardless of activity. Lastly, due to the current study design, the findings could not prove causation and raise concerns for measurement validity. The questionnaire was developed for this study and was not independently validated, and internal consistency was low for two of the three study-specific composites.

Despite these limitations, the findings provide preliminary evidence that long-term Taekwondo training is associated with how adolescents with ADHD perceive their own self-regulation, which makes it worth investigating further as a possible complement to standard ADHD management. Future research should use a longitudinal design that surveys and interviews adolescents with ADHD before they begin Taekwondo and again after several months of training, which would make it possible to actually measure change over time rather than relying on a person's self-perception that could easily change in a day. Larger samples, clinically confirmed diagnoses, and a non-Taekwondo comparison group would also considerably strengthen the conclusions that future studies can draw.

CONCLUSION

This study is an exploratory study, set out to examine how long-term Taekwondo training relates to attention control and emotional regulation in adolescents with and without ADHD. ADHD affects a large number of adolescents, and since standard treatments don't always cover every symptom, complementary approaches remain important to investigate. This study focused on Taekwondo because its structure aligns with developing the skills that individuals with ADHD often find challenging. Overall, participants reported fairly high levels of attention control, emotional regulation, and self-control, and the ADHD group in particular reported higher self-perceived attention control than the non-ADHD group. However, this difference does not indicate that Taekwondo caused better attention or that participants with ADHD

had better attentional ability objectively. The interviews suggested that it is not simply the years of practice that matter, but the specific structure of the training itself, which includes discipline, the repetition of Poomsae, the pressure of sparring, and also the individual responsibility that comes with an independent sport.

Because the sample size was small, the ADHD status was self-reported, the survey and interview samples were separate, and there wasn't a proper non-Taekwondo comparison group, these results should be taken into consideration with caution. The findings therefore do not directly establish that Taekwondo has an impact on ADHD or qualifies as an effective therapeutic treatment but do provide tentative evidence of associations between long-term Taekwondo participation and self-reported self-regulation and shed light on what aspects of training adolescents report as being beneficial. Future research should explore these patterns with larger samples, validated measures, longitudinal designs, and comparison groups engaged in other structured physical activities to establish replicability of the associations observed here and to determine if they are specific to Taekwondo.

REFERENCES

- Antshel, K. M., & Barkley, R. A. (2008). Psychosocial interventions in attention deficit hyperactivity disorder. *Child and Adolescent Psychiatric Clinics of North America*, 17(2), 421–437. <https://doi.org/10.1016/j.chc.2007.11.005>
- Bunford, N., Evans, S. W., & Wymbs, F. (2015). ADHD and emotion dysregulation among children and adolescents. *Clinical Child and Family Psychology Review*, 18(3), 185–217. <https://doi.org/10.1007/s10567-015-0187-5>
- Chan, E., Fogler, J. M., & Hammerness, P. G. (2016). Treatment of attention-deficit/hyperactivity disorder in adolescents: A systematic review. *JAMA*, 315(18), 1997–2008. <https://doi.org/10.1001/jama.2016.5453>
- Christiansen, H., Hirsch, O., Albrecht, B., & Chavanon, M. L. (2019). Attention-deficit/hyperactivity disorder (ADHD) and emotion regulation over the life span. *Current Psychiatry Reports*, 21(3), 17. <https://doi.org/10.1007/s11920-019-1003-6>
- De Crescenzo, F., Cortese, S., Adamo, N., & Janiri, L. (2017). Pharmacological and non-pharmacological treatment of adults with ADHD: A meta-review. *Evidence-Based Mental Health*, 20(1), 4–11. <https://doi.org/10.1136/eb-2016-102415>
- Hirsch, O., Chavanon, M. L., Riechmann, E., & Christiansen, H. (2018). Emotional dysregulation is a primary symptom in adult Attention-Deficit/Hyperactivity Disorder (ADHD). *Journal of Affective Disorders*, 232, 41–47. <https://doi.org/10.1016/j.jad.2018.02.007>
- Hurtig, T., Ebeling, H., Taanila, A., Miettunen, J., Smalley, S. L., McGough, J. J., Loo, S. K., Järvelin, M. R., & Moilanen, I. K. (2007). ADHD symptoms and subtypes: Relationship between childhood

- and adolescent symptoms. *Journal of the American Academy of Child & Adolescent Psychiatry*, 46(12), 1605–1613. <https://doi.org/10.1097/chi.0b013e318157517a>
- Kadri, A. (2021). The Poomsae in Taekwondo is an effective therapy for executive function in children with Attention Deficit Hyperactivity Disorder. *SAJ Case Reports*, 8(1), Article 104, 1–11. <https://doi.org/10.18875/2375-7043.8.104>
- Kadri, A., Slimani, M., Bragazzi, N. L., Tod, D., & Azaiez, F. (2019). Effect of taekwondo practice on cognitive function in adolescents with attention deficit hyperactivity disorder. *International Journal of Environmental Research and Public Health*, 16(2), 204. <https://doi.org/10.3390/ijerph16020204>
- Lakes, K. D., & Hoyt, W. T. (2004). Promoting self-regulation through school-based martial arts training. *Journal of Applied Developmental Psychology*, 25(3), 283–302. <https://doi.org/10.1016/j.appdev.2004.04.002>
- Nakonechnyi, I., & Galan, Y. (2017). Development of behavioural self-regulation of adolescents in the process of mastering martial arts. *Journal of Physical Education and Sport*, 17(3), 1002–1008.
- Nazarova, V. A., Sokolov, A. V., Chubarev, V. N., Tarasov, V. V., & Schiöth, H. B. (2022). Treatment of ADHD: Drugs, psychological therapies, devices, complementary and alternative methods as well as the trends in clinical trials. *Frontiers in Pharmacology*, 13, 1066988. <https://doi.org/10.3389/fphar.2022.1066988>
- Polanczyk, G. V., Salum, G. A., Sugaya, L. S., Caye, A., & Rohde, L. A. (2015). Annual research review: A meta-analysis of the worldwide prevalence of mental disorders in children and adolescents. *Journal of Child Psychology and Psychiatry*, 56(3), 345–365. <https://doi.org/10.1111/jcpp.12381>
- Sibley, M. H., Pelham, W. E., Molina, B. S. G., Gnagy, E. M., Waschbusch, D. A., Garefino, A. C., Kuriyan, A. B., Babinski, D. E., & Karch, K. M. (2012). Diagnosing ADHD in adolescence. *Journal of Consulting and Clinical Psychology*, 80(1), 139–150. <https://doi.org/10.1037/a0026577>
- Shraim, Z. F. (2024). Effects of a Taekwondo-inspired intervention program on children with ADHD (Master's thesis, United Arab Emirates University). https://scholarworks.uaeu.ac.ae/cgi/viewcontent.cgi?article=1123&context=thesis_dissertation_defense
- Suchołbiak, A., Mikołajczyk, O., Serafin, A., & Jarzęcka, U. (2025). Martial arts as complementary interventions to support ADHD-related symptom control. *Biuletyn Główniej Biblioteki Lekarskiej*, 58(384), 27–38. <https://doi.org/10.2478/bgbl-2025-0003>
- Sun, W., Yu, M., & Zhou, X. (2022). Effects of physical exercise on attention deficit and other major symptoms in children with ADHD: A meta-analysis. *Psychiatry Research*, 311, 114509. <https://doi.org/10.1016/j.psychres.2022.114509>

- Vysniauske, R., Verburgh, L., Oosterlaan, J., & Molendijk, M. L. (2020). The effects of physical exercise on functional outcomes in the treatment of ADHD: A meta-analysis. *Journal of Attention Disorders*, 24(5), 644–654. <https://doi.org/10.1177/1087054715627489>
- Wehmeier, P. M., Schacht, A., & Barkley, R. A. (2010). Social and emotional impairment in children and adolescents with ADHD and the impact on quality of life. *Journal of Adolescent Health*, 46(3), 209–217. <https://doi.org/10.1016/j.jadohealth.2009.09.009>
- Willoughby, M. T. (2003). Developmental course of ADHD symptomatology during the transition from childhood to adolescence: A review with recommendations. *Journal of Child Psychology and Psychiatry*, 44(1), 88–106. <https://doi.org/10.1111/1469-7610.t01-1-00104>
- Xie, Y., Gao, X., Song, Y., Zhu, X., Chen, M., Yang, L., & Ren, Y. (2021). Effectiveness of physical activity intervention on ADHD symptoms: A systematic review and meta-analysis. *Frontiers in Psychiatry*, 12, 706625. <https://doi.org/10.3389/fpsy.2021.706625>
- Young, S., & Amarasinghe, J. M. (2010). Practitioner review: Non-pharmacological treatments for ADHD: A lifespan approach. *Journal of Child Psychology and Psychiatry*, 51(2), 116–133. <https://doi.org/10.1111/j.1469-7610.2009.02191.x>

APPENDIX A Survey Questions

Background Questions (Non-Scaled)

- Age:
- Years of Taekwondo training:
- Weekly training frequency:
- Self-reported ADHD diagnosis (Yes / No):

A. Attention Control

- I can concentrate on instructions during Taekwondo class.
- I find it easy to stay focused throughout training.
- I get distracted during Taekwondo practice. (*reverse-coded*)
- Taekwondo training has improved my ability to focus in daily life or school.

B. Emotional Regulation

- I can control my anger during training.
- I stay calm when I make mistakes in Taekwondo.
- I get frustrated easily during practice. (*reverse-coded*)
- I feel anxious during Taekwondo training. (*reverse-coded*)
- I can manage feelings of anxiety during practice.
- I feel confident during Taekwondo training.
- Taekwondo training has helped me manage my emotions better outside of practice.

C. Impulsivity / Self-Control

- I think before I act during Taekwondo practice.
- I can wait patiently for my turn during class.
- I can control my impulsivity during training.
- I act without thinking during Taekwondo practice. (*reverse-coded*)
- I can control my body and stay still when required during training.
- Taekwondo training has improved my self-control in situations outside of class.

APPENDIX B. Interview Questions

1. Can you describe how Taekwondo has affected your ability to focus in class or daily life?
2. Have you noticed any changes in how you handle anger or frustration (or anxiety) since starting Taekwondo? (Emotional Regulation)
3. How has your ability to focus changed since you started Taekwondo? (Attention)
4. Which parts of Taekwondo training help you the most with self-control? Why?
5. Do you think Taekwondo helps you differently compared to other activities or sports?
6. Would you recommend Taekwondo to others with ADHD? Do you think it is a good method to cope with/control ADHD?

(Optional follow-up Qs OR Personal Questions)