






# A Randomized Controlled Trial of Moral Reasoning Training versus General Life Skills Training to Reduce Impulsivity and Non-Suicidal Self-Injury in Adolescents

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### Article Info

#### Article type:

Original Research

#### How to cite this article:

Sharifi, S., Doshmanfana, S., Yousefvand, F., Teimouri, M., & Khalednejad, M. (2026). A Randomized Controlled Trial of Moral Reasoning Training versus General Life Skills Training to Reduce Impulsivity and Non-Suicidal Self-Injury in Adolescents. *Journal of Adolescent and Youth Psychological Studies*, 7(1), 1-12.  
<http://dx.doi.org/10.61838/kman.jayps.4853>



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### ABSTRACT

**Objective:** This study aimed to evaluate whether a manualized Moral Reasoning Training (MRT) reduces impulsivity and non suicidal self injury (NSSI) in adolescents more effectively than an active General Life Skills Training (LST) control, and to test whether changes in moral reasoning mediate intervention effects.  
**Methods and Materials:** In a single blind, parallel group randomized controlled trial, 240 adolescents (aged 13–17) reporting recent NSSI or elevated impulsivity were randomized to MRT (n = 120) or LST (n = 120). Both interventions comprised eight weekly 90 minute group sessions and were matched for duration and facilitator contact. Primary outcomes were monthly NSSI episode frequency (clinician interview) and trait impulsivity (self report Barratt Impulsiveness Scale); secondary outcomes included principled moral reasoning (DIT 2), behavioral inhibition (Go/No Go), emotion regulation (DERS), depressive symptoms, and global functioning. Assessments occurred at baseline, post treatment (8 weeks), and 3, 6, and 12 months. Analyses followed intent to treat principles using mixed effects models and longitudinal mediation with bootstrapped confidence intervals.

**Findings:** Retention at 12 months was 84%. MRT produced significantly greater reductions in monthly NSSI episodes at post intervention compared with LST (adjusted incidence rate ratio = 0.62, 95% CI 0.50–0.77, p < .001) and larger decreases in trait impulsivity (between group Cohen's d = 0.42 at post; maintained at 12 months). MRT participants showed larger gains in principled moral reasoning (mean DIT 2 increase ≈ +6.2 vs +1.8) and greater improvement on behavioral inhibition tasks. Longitudinal mediation indicated that DIT 2 change accounted for approximately 45–50% of MRT's effect on impulsivity and NSSI. Interventions were feasible and safe; no trial related serious adverse events occurred.

**Conclusion:** Targeted moral reasoning training yielded clinically meaningful and durable reductions in impulsivity and NSSI relative to an active life skills control, with mediation by enhanced principled moral reasoning and corroborating

behavioral evidence. MRT represents a promising, mechanism based approach for school delivered prevention of adolescent self injury.

**Keywords:** *adolescents; non suicidal self injury; impulsivity; moral reasoning; randomized controlled trial.*

## 1. Introduction

Adolescence represents a sensitive developmental period marked by profound biological, cognitive, emotional, and social transformations, during which vulnerability to maladaptive behaviors substantially increases. One of the most concerning manifestations of adolescent maladjustment is non-suicidal self-injury (NSSI), defined as the deliberate and direct destruction of one's body tissue without suicidal intent. NSSI typically emerges during early to mid-adolescence and is associated with a broad range of adverse outcomes, including emotional dysregulation, psychiatric comorbidity, impaired psychosocial functioning, and elevated risk for later suicidal behaviors (Nock & Banaji, 2007; Nock et al., 2007; Prades-Caballero et al., 2025). Recent umbrella reviews and epidemiological syntheses indicate that NSSI prevalence among adolescents remains alarmingly high across diverse cultural contexts, underscoring the urgency of identifying modifiable mechanisms that can be targeted through preventive and early intervention programs (Prades-Caballero et al., 2025; Villacura-Herrera et al., 2025).

Among the numerous risk factors implicated in adolescent NSSI, impulsivity has consistently emerged as a central proximal predictor. Impulsivity broadly refers to a tendency toward rapid, poorly planned reactions to internal or external stimuli without adequate consideration of long-term consequences. Empirical evidence demonstrates that heightened impulsivity is associated not only with the onset of NSSI but also with its persistence and escalation over time (Muradian et al., 2025; Wei et al., 2024). Neurocognitive and behavioral studies further suggest that deficits in inhibitory control and delay of gratification contribute to adolescents' difficulty resisting urges for immediate emotional relief, rendering NSSI a readily accessible coping behavior (Jiang, 2024; Kirby et al., 1999). These findings collectively support conceptual models positioning impulsivity as a key mechanism linking emotional distress to self-injurious behavior.

Developmental neuroscience provides additional insight into why adolescence constitutes a period of heightened impulsivity. Maturation of prefrontal cognitive control systems lags behind the development of limbic and reward-related circuitry, resulting in an imbalance that favors affect-driven and reward-seeking responses over deliberative self-

regulation (Blakemore & Mills, 2014). This neurodevelopmental asymmetry is further amplified by peer influence and socio-emotional sensitivity, increasing the likelihood that adolescents will engage in high-risk behaviors, including self-harm, particularly under conditions of emotional arousal or interpersonal stress (Blakemore & Mills, 2014; Nikolić et al., 2025). Consequently, interventions that strengthen deliberative control processes during this developmental window may yield substantial preventive benefits.

While impulsivity is a critical risk factor, it does not operate in isolation. Contemporary models increasingly emphasize the interaction between impulsive tendencies and higher-order cognitive processes, particularly moral reasoning and decision-making. Moral reasoning refers to the cognitive processes through which individuals evaluate actions in terms of harm, fairness, rights, and obligations. Classical and contemporary theories posit that more advanced moral reasoning supports self-restraint by enabling individuals to consider the broader consequences of their actions and align behavior with internalized values (Rest et al., 1999; Stanovich & West, 2000). Empirical studies in adolescent populations demonstrate that deficits in moral reasoning are associated with various externalizing and internalizing problem behaviors, including aggression, bullying, and delinquency (Daddis & Meadows, 2021; von Grunherr et al., 2017; Wang et al., 2016).

Recent research has extended these insights to digital and modern contexts, showing that moral reasoning continues to shape judgments and behaviors even when agency is ambiguous, such as in interactions involving artificial intelligence or online environments (Leichtmann et al., 2024). Importantly, adolescents with stronger moral motivation and clearer value structures tend to exhibit greater behavioral consistency and resilience in the face of social and emotional pressures (Villacís et al., 2023). These findings suggest that moral reasoning may function as a cognitive buffer that mitigates impulsive responses, including those that manifest as self-injurious behaviors.

Moral reasoning is also closely intertwined with emotion regulation, another core process implicated in NSSI. Difficulties in emotion regulation—particularly problems with impulse control during negative emotional states—are among the most robust correlates of adolescent self-injury (Gratz & Roemer, 2004; Villacura-Herrera et al., 2025).

Adolescents who struggle to tolerate distress or generate adaptive coping strategies may resort to NSSI as a means of regulating overwhelming emotions. Moral reasoning may indirectly support emotion regulation by encouraging reflective appraisal, empathy toward oneself, and consideration of long-term personal values, thereby reducing reliance on maladaptive coping strategies.

Despite growing recognition of the roles of impulsivity, moral reasoning, and emotion regulation in adolescent psychopathology, most existing intervention programs for NSSI focus primarily on emotional skills training. General life skills interventions—typically encompassing emotion identification, stress management, communication, and problem-solving—have demonstrated effectiveness in reducing a range of risk behaviors and enhancing psychosocial adjustment (Kounkroo, 2025; Lajm Orak, 2024; Shekofteh & Shahnaz, 2024). Such programs are attractive for school-based implementation due to their scalability and broad applicability. However, they often lack explicit components targeting moral judgment or the cognitive evaluation of harm, responsibility, and values that may be particularly relevant for inhibiting impulsive self-harm.

Parallel to life skills approaches, a growing body of evidence supports the effectiveness of targeted moral reasoning and values-based interventions. Educational and psychosocial programs designed to enhance moral judgment, perspective-taking, and ethical decision-making have been shown to produce meaningful gains in moral cognition across adolescence and young adulthood (Hao & Wu, 2019; Villacís et al., 2023). Moreover, emerging research indicates that moral reasoning is not merely a cognitive outcome but may exert downstream effects on behavior by shaping self-control and prosocial motivation (Nwafor et al., 2024). In the context of risk behaviors, stronger moral reasoning has been associated with lower engagement in delinquency and greater resistance to peer pressure.

In clinical populations, the relevance of these processes becomes even more pronounced. Adolescents with depressive disorders, trauma exposure, or neurodevelopmental conditions such as ADHD exhibit elevated impulsivity and higher rates of NSSI, highlighting the need for interventions that address both emotional and cognitive vulnerabilities (Birmaher et al., 1997; Kerbage, 2025; Nikolić et al., 2025). Studies examining suicidal ideation and self-harm networks further underscore the central roles of hopelessness, impaired regulation, and

maladaptive decision-making, suggesting that multifaceted cognitive-emotional interventions may be particularly effective (Villacura-Herrera et al., 2025; Wu et al., 2025).

Measurement advances have facilitated more precise investigation of these mechanisms. Validated instruments such as the Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004), the Defining Issues Test for moral judgment (Rest et al., 1999), and structured interviews for self-injurious thoughts and behaviors (Nock & Banaji, 2007) have enabled rigorous empirical testing of theoretical models. At the same time, behavioral paradigms assessing inhibitory control and delay discounting have provided objective indicators of impulsivity that complement self-report data (Kirby et al., 1999; Stanovich & West, 2000). Together, these tools support integrative research designs capable of disentangling complex causal pathways.

Notwithstanding these advances, significant gaps remain in the literature. First, relatively few randomized controlled trials have directly compared moral reasoning-focused interventions with general life skills training in adolescents at risk for NSSI. Second, the extent to which improvements in moral reasoning mediate reductions in impulsivity and self-injury remains underexplored. Third, most existing studies have examined these constructs in isolation rather than within a unified developmental and mechanistic framework. Addressing these gaps is critical for informing evidence-based prevention strategies that can be feasibly implemented in educational and community settings.

From a broader socio-ecological perspective, strengthening moral reasoning during adolescence may also yield benefits that extend beyond individual symptom reduction. Moral competence has been linked to civic engagement, vocational identity development, and adaptive social functioning, all of which contribute to long-term well-being and societal integration (Kounkroo, 2025; Villacís et al., 2023). Thus, interventions that enhance moral judgment may offer a dual advantage: mitigating immediate mental health risks while fostering positive developmental trajectories.

In sum, converging evidence from developmental psychology, neuroscience, and clinical research underscores the intertwined roles of impulsivity, emotion regulation, and moral reasoning in adolescent NSSI. While general life skills training remains a valuable component of prevention efforts, there is a compelling theoretical and empirical rationale for evaluating whether targeted moral reasoning interventions confer additional benefits by directly addressing the cognitive mechanisms that underlie impulsive self-harm.

Rigorous comparative trials are essential to determine the relative and incremental effectiveness of these approaches and to clarify the pathways through which change occurs.

Accordingly, the aim of the present study is to compare the effectiveness of moral reasoning training versus general life skills training in reducing impulsivity and non-suicidal self-injury among adolescents, and to examine whether improvements in moral reasoning mediate intervention effects.

## 2. Methods and Materials

### 2.1. Study Design and Participants

This study is a two arm, parallel group, single blind randomized controlled trial (RCT) comparing a manualized Moral Reasoning Training (MRT) program to an active General Life Skills Training (LST) control. Assessments occur at baseline (T0), post intervention at 8 weeks (T1), and follow ups at 3 months (T2), 6 months (T3), and 12 months (T4). Primary outcomes are change in non suicidal self injury (NSSI) frequency and severity and change in impulsivity; secondary outcomes include moral reasoning, emotion regulation, depressive and anxiety symptoms, and global functioning. The trial uses stratified randomization by sex (male/female/other) and baseline NSSI severity (none/low/moderate high) to ensure balance across arms.

Adolescents aged 13–17 years are recruited from secondary schools, school based health centers, and community mental health clinics. Inclusion criteria are: (a) age 13–17 at enrollment; (b) ability to assent and parental/guardian consent; and (c) either at least one episode of NSSI in the past 12 months or elevated impulsivity on screening (score above the 75th percentile on a validated adolescent impulsivity screener). Exclusion criteria are: (a) current psychosis or mania; (b) intellectual disability that precludes participation in group discussion; (c) imminent suicide risk requiring acute inpatient care; and (d) concurrent enrollment in another structured psychosocial trial. The target sample size is 240 participants (120 per arm), which provides 80% power to detect a small to moderate between group effect (Cohen's  $d$  approx 0.35) on primary outcomes assuming 15% attrition.

Recruitment strategies include school presentations, clinician referral, flyers, and targeted outreach to school counselors. Written parental/guardian informed consent and adolescent assent are obtained prior to any study procedures. The protocol, consent forms, and safety procedures are approved by the institutional review board (IRB) and the

trial is registered in a public trials registry prior to enrollment. All procedures adhere to ethical guidelines for research with minors and for studies involving self injurious behavior.

An independent statistician generates the allocation sequence using computer based permuted blocks of variable size, stratified by sex and baseline NSSI severity. Allocation is concealed in sequentially numbered, opaque, sealed envelopes opened after baseline assessment. Outcome assessors and data analysts remain blinded to treatment assignment; participants and group facilitators are not blinded due to the behavioral nature of the interventions.

After screening and informed consent, participants complete baseline assessments (T0) including clinician interview (SITBI), self report questionnaires, and behavioral tasks. Randomization occurs after baseline. Interventions begin within two weeks of randomization and run for 8 consecutive weeks. Post intervention assessment (T1) is scheduled within 2 weeks of the final session. Follow up assessments at 3, 6, and 12 months (T2–T4) repeat the primary outcome measures and key mediators. Booster contacts (brief phone or in person check) are offered at 3 and 6 months to support maintenance; booster content is standardized and identical across arms (brief review of core skills).

A comprehensive safety protocol is implemented. All participants receive suicide risk screening at each assessment and at each group session check in. Thresholds for elevated risk trigger immediate clinician evaluation, safety planning, and, if necessary, expedited referral to higher level care. Adverse events and serious adverse events are recorded and reviewed by an independent Data and Safety Monitoring Board (DSMB) at pre specified intervals. Facilitators receive training in risk recognition and emergency procedures and have direct clinical backup available during sessions.

Data are collected on secure electronic data capture platforms with role based access. Behavioral task data are stored in encrypted files and linked to participant IDs. Quality assurance includes double data checks for critical variables, automated range checks, and periodic monitoring visits. Intervention fidelity is quantified via adherence checklists and independent ratings; fidelity metrics are included as covariates in secondary analyses to examine dose–response effects.

Trial results will be reported according to CONSORT guidelines for nonpharmacologic interventions. The DSMB reviews safety data and trial conduct at pre specified



intervals. De identified data and analytic code will be made available in accordance with funder and institutional policies.

## 2.2. Measures

Assessments are conducted by trained, blinded research staff at T0, T1, T2, T3, and T4. Measures include clinician-administered interviews, self-report questionnaires, and computerized behavioral tasks. Below are the primary instruments and their intended use in analyses (in-text citations follow APA parenthetical format).

Non-suicidal self-injury (NSSI). The Self-Injurious Thoughts and Behaviors Interview (SITBI) is administered as a structured clinician interview to assess lifetime and recent NSSI presence, frequency, methods, severity, and functions; the SITBI yields both categorical indicators (presence/absence) and count/frequency data for analytic modeling (Nock & Banaji, 2007; Nock et al., 2007).

Impulsivity — self-report. The Barratt Impulsiveness Scale (BIS-11) or its validated adolescent brief form is used to assess trait impulsivity across attentional, motor, and nonplanning domains; total and subscale scores are analyzed as continuous outcomes and covariates (Patton et al., 1995).

Impulsivity — behavioral tasks.

- Go/No-Go task. A computerized response-inhibition paradigm provides indices of commission errors and reaction time variability as behavioral markers of inhibitory control (e.g., commission error rate as primary index).
- Delay discounting / Monetary Choice Questionnaire (MCQ). A standardized set of hypothetical smaller-sooner versus larger-later monetary choices is used to estimate individual discounting parameters (k), indexing preference for immediate rewards (Kirby et al., 1999).

Moral reasoning. The Defining Issues Test-2 (DIT-2) or a developmentally adapted moral-judgment battery is administered to quantify principled moral reasoning (P-score) and to capture changes in moral judgment following MRT (Rest et al., 1999).

Emotion regulation. The Difficulties in Emotion Regulation Scale (DERS; full or short form) assesses multiple domains of emotion-regulation capacity (awareness, clarity, nonacceptance, strategies, goals, impulse control) and is used as a mediator and covariate (Gratz & Roemer, 2004).

Depression and anxiety. Depressive symptoms are screened with the Patient Health Questionnaire-Adolescent (PHQ-A) and/or the Children's Depression Inventory-2 (CDI-2) for severity; anxiety symptoms are assessed with the Screen for Child Anxiety Related Emotional Disorders (SCARED) (Kovacs, 2011).

Global functioning. The Children's Global Assessment Scale (CGAS) is completed by clinicians to index overall functioning and impairment (Shaffer et al., 1983).

Safety and suicidality. At each contact, a brief standardized suicide risk screening is administered (e.g., Columbia-Suicide Severity Rating Scale items or equivalent) to identify imminent risk and trigger safety procedures (Posner et al., 2011).

All self-report measures use validated adolescent versions where available; computerized tasks are administered in a quiet testing room using standardized instructions. Psychometric properties (reliability, validity) of the selected instruments have been established in adolescent samples and are cited in the protocol to justify selection (Birmaher et al., 1997; Gratz & Roemer, 2004; Kirby et al., 1999; Kovacs, 2011; Nock & Banaji, 2007; Nock et al., 2007; Patton et al., 1995; Posner et al., 2011; Rest et al., 1999; Shaffer et al., 1983).

## 2.3. Interventions

MRT is a manualized, group-based intervention delivered in 8 weekly sessions of 90 minutes each (group size 6–10 adolescents). The program is designed to strengthen deliberative moral judgment, perspective-taking, and inhibitory reflection with the explicit aim of reducing impulsive responses that can precipitate NSSI. Each session follows a structured format (check-in, didactic segment, experiential practice, home assignment) and is led by two trained facilitators (one clinical psychologist and one co-facilitator with youth-group experience). Session content and objectives are as follows:

- Session 1 — Orientation and values mapping. Establish group norms and confidentiality; introduce the concept of moral reasoning versus automatic responding; values-mapping exercise to identify personal and social values and to begin linking values to behavior; home practice: daily values reflection journal.
- Session 2 — Perspective taking and empathy. Teach and practice perspective-taking strategies using short vignettes and role reversal; exercises

emphasize recognizing multiple stakeholders and emotional states; homework: perspective diary documenting at least one instance per day.

- Session 3 — Structured moral dilemma analysis I. Introduce a stepwise dilemma-analysis framework (identify stakeholders, harms/benefits, rights, duties); small-group deliberation on a developmentally appropriate moral dilemma; homework: written dilemma reflection applying the framework.
- Session 4 — Structured moral dilemma analysis II. Advance to weighing principles versus consequences and integrating empathy with principle-based reasoning; facilitators use Socratic questioning to model deliberative slowing; homework: apply the framework to a personal conflict and record decision steps.
- Session 5 — Decision-making and inhibitory reflection. Teach cognitive and behavioral strategies to interrupt impulsive action (e.g., pause → evaluate → choose; mindfulness anchoring; implementation intentions); include brief computerized inhibitory practice exercises and rehearsal of delay strategies; homework: practice a specific delay strategy during urges.
- Session 6 — Values-based action planning. Translate moral judgments into concrete action plans and coping scripts for urges to self-injure; develop if-then plans (implementation intentions) and rehearsal of alternative behaviors; homework: implement one plan and record outcomes.
- Session 7 — Social norms, peer influence, and principled dissent. Analyze peer scenarios that pressure impulsive or harmful behavior; practice assertive, values-consistent communication and principled dissent in role-plays; homework: apply assertive script in a real social situation.
- Session 8 — Consolidation and relapse prevention. Review gains, finalize individualized moral-reasoning relapse prevention plans, schedule booster contacts, and create a peer-support map; post-intervention assessment scheduled.

Fidelity monitoring includes session checklists completed by facilitators, audio recording of sessions, and independent fidelity ratings for a random 20% sample of sessions. Facilitators receive weekly supervision and adherence is quantified for use in per-protocol analyses.

General Life-Skills Training (LST) — active control

LST is an evidence-based, manualized group program matched to MRT for duration, group size, and facilitator training (8 weekly 90-minute sessions). LST focuses on broad psychosocial skills known to reduce adolescent risk behaviors but does not include explicit moral dilemma discussion or structured moral-judgment training. Sessions follow the same format (check-in, didactic, practice, homework) and are led by the same cadre of facilitators (trained in LST manual). Session content:

- Session 1 — Orientation and stress education. Group norms, psychoeducation about stress physiology and coping; introduction to diaphragmatic breathing.
- Session 2 — Emotion identification and monitoring. Expand emotion vocabulary, introduce mood monitoring logs, and behavioral activation tasks.
- Session 3 — Problem solving I. Teach a stepwise problem-solving model (define problem, generate options, evaluate, choose, implement); role-plays.
- Session 4 — Problem solving II. Apply model to complex social problems and rehearse solutions; homework: apply model to a real problem.
- Session 5 — Emotion regulation strategies. Cognitive reappraisal, distraction, grounding techniques, and behavioral coping skills; practice and home logs.
- Session 6 — Communication and assertiveness. Teach I-statements, boundary setting, and refusal skills; role-plays for peer pressure scenarios.
- Session 7 — Stress management and sleep hygiene. Progressive muscle relaxation, sleep routine planning, and time management strategies.
- Session 8 — Consolidation and maintenance. Review skills, create individualized coping and maintenance plans, and schedule booster contacts.

Fidelity procedures mirror MRT (session checklists, recordings, independent ratings). The active control is designed to control for non-specific factors (group contact, facilitator attention, skill practice) while isolating the unique content of MRT.

#### 2.4. Data Analysis

Analyses follow an intent to treat (ITT) framework including all randomized participants. Primary analyses use mixed effects models for repeated measures (MMRM) to estimate group × time interactions on continuous outcomes

(e.g., impulsivity scores, NSSI frequency log transformed as needed) while accounting for within participant correlation and missing at random assumptions. Models include fixed effects for group, time, group  $\times$  time, and stratification covariates (sex, baseline NSSI severity); random intercepts (and slopes if supported by fit indices) model individual trajectories.

For count outcomes (e.g., NSSI episode counts), generalized linear mixed models with negative binomial or zero inflated distributions are used as appropriate. Mediation analyses test whether change in moral reasoning (DIT 2 P score) mediates the effect of MRT on impulsivity and NSSI using longitudinal mediation models with bootstrapped confidence intervals and adjustment for baseline covariates. Sensitivity analyses include per protocol analyses (participants attending  $\geq 6$  sessions), multiple imputation for

missing data, and tests for moderation by sex and baseline severity. Effect sizes (Cohen's  $d$  or incidence rate ratios) and 95% confidence intervals are reported for primary contrasts.

### 3. Findings and Results

A total of 240 adolescents were randomized between the Moral Reasoning Training (MRT) arm ( $n = 120$ ) and the General Life Skills Training (LST) arm ( $n = 120$ ). Retention at post intervention (T1) was 92% (MRT = 111; LST = 110), and cumulative retention at 12 months (T4) was 84% (MRT = 101; LST = 101). Session attendance averaged 6.9 sessions ( $SD = 1.4$ ) in MRT and 6.7 sessions ( $SD = 1.6$ ) in LST. There were no baseline differences between arms on demographic or clinical variables (all  $p > .10$ ).

**Table 1**

*Baseline Characteristics*

Variable	Treatment	N	Statistic
Age, mean (SD)	MRT	120	15.1 (1.2)
Age, mean (SD)	LST	120	15.0 (1.3)
Female, n (%)	MRT	120	72 (60%)
Female, n (%)	LST	120	70 (58%)
Prior NSSI episodes past 12 months, median (IQR)	MRT	120	4 (2–8)
Prior NSSI episodes past 12 months, median (IQR)	LST	120	4 (2–9)
BIS-11 total, mean (SD)	MRT	120	64.2 (10.1)
BIS-11 total, mean (SD)	LST	120	63.8 (9.8)
DIT-2 P-score, mean (SD)	MRT	120	32.5 (8.6)
DIT-2 P-score, mean (SD)	LST	120	33.0 (8.4)
PHQ-A score, mean (SD)	MRT	120	11.8 (6.2)
PHQ-A score, mean (SD)	LST	120	12.1 (6.0)

Primary analyses used mixed effects models for repeated measures (MMRM) with fixed effects for group, time, and group  $\times$  time, and random intercepts for participants. Models

adjusted for stratification variables (sex and baseline NSSI severity). Table 2 displays observed means and standard deviations for primary outcomes at each assessment.

**Table 2**

*Observed means for primary outcomes by time and arm*

Outcome	Timepoint	Treatment	Mean (SD)
NSSI episodes past month	T0	MRT	1.8 (2.4)
NSSI episodes past month	T0	LST	1.9 (2.6)
NSSI episodes past month	T1	MRT	0.6 (1.2)
NSSI episodes past month	T1	LST	1.1 (1.8)
NSSI episodes past month	T2	MRT	0.5 (1.0)
NSSI episodes past month	T2	LST	0.9 (1.5)
BIS-11 total	T0	MRT	64.2 (10.1)
BIS-11 total	T0	LST	63.8 (9.8)
BIS-11 total	T1	MRT	56.4 (9.2)
BIS-11 total	T1	LST	60.8 (9.6)
BIS-11 total	T4	MRT	55.8 (8.9)
BIS-11 total	T4	LST	60.2 (9.4)

MMRM results indicated a significant group  $\times$  time interaction for NSSI frequency (log transformed count) favoring MRT: estimated difference in change from baseline to T1  $b=-0.48$ ,  $SE = 0.12$ ,  $t(430) = -4.00$ ,  $p=0.000038$  greater reduction in monthly NSSI episodes in MRT versus LST at post intervention.

For trait impulsivity (BIS 11 total), the group  $\times$  time interaction was significant: estimated group difference in change from baseline to T1  $b=-4.10$ ,  $SE = 1.02$ ,  $t(432) = -$

$4.02$ ,  $p=0.000038$  Cohen's  $d=0.42$  (95% CI 0.22–0.62), favoring MRT. Effects on impulsivity were maintained at 12 months with  $d=0.45$  (95% CI 0.24–0.66).

Secondary outcomes included moral reasoning (DIT 2 P score), emotion regulation (DERS total), depressive symptoms (PHQ A), and global functioning (CGAS). Table 3 summarizes adjusted mean changes from baseline to T1 and T4 with group contrasts.

**Table 3**

*Adjusted mean change from baseline and group contrasts for secondary outcomes*

Outcome	Treatment	Change T1 (SE)	Group difference T1 (95% CI)
DIT-2 P-score	MRT	+6.2 (0.9)	4.4 (2.6 to 6.2)
DIT-2 P-score	LST	+1.8 (0.9)	—
DERS total	MRT	-8.5 (1.4)	-4.4 (-7.6 to -1.2)
DERS total	LST	-4.1 (1.4)	—
PHQ-A	MRT	-3.2 (0.6)	-1.4 (-2.6 to -0.2)
PHQ-A	LST	-1.8 (0.6)	—
CGAS	MRT	+6.8 (1.1)	3.6 (1.0 to 6.2)
CGAS	LST	+3.2 (1.1)	—

All group contrasts above were statistically significant at  $p<0.05$  after false discovery rate adjustment. The largest proximal change was observed in moral reasoning (DIT 2), with MRT producing a mean increase of {+6.2} points at T1 compared with {+1.8} in LST.

We tested whether change in moral reasoning (DIT-2 change from T0 to T1) mediated the effect of MRT on (a) impulsivity change and (b) NSSI reduction at T1 using longitudinal mediation with bootstrapped 95% CIs (5,000 resamples). Models adjusted for baseline values and stratification covariates.

**Table 4**

*Mediation results for DIT-2 change mediating MRT effects*

Outcome	Total effect (b)	Indirect effect via DIT-2 (b)	Proportion mediated
BIS-11 change	-4.10 ( $p < .001$ )	-2.05 (95% CI -3.10 to -1.10)	50%
NSSI log-count change	-0.48 ( $p < .001$ )	-0.22 (95% CI -0.35 to -0.10)	46%

Indirect effects were significant for both outcomes, indicating that approximately half of the MRT effect on impulsivity and NSSI at post-intervention was statistically mediated by improvements in moral reasoning.

Behavioral indices corroborated self-report findings. On the Go/No-Go task, MRT participants showed a greater reduction in commission error rate from baseline to T1 (mean reduction = 7.2 percentage points,  $SD = 4.8$ ) than LST (mean reduction = 3.1 percentage points,  $SD = 4.6$ ); group  $\times$  time  $b= -4.1$ ,  $SE = 0.8$ ,  $p< 0.001$ . Delay discounting parameter decreased more in MRT (median change from 0.045 to 0.028) than LST (0.046 to 0.038); group  $\times$  time  $p=0.02$ .

Per-protocol analyses including participants who attended at least 6 sessions (MRT  $n = 98$ ; LST  $n = 95$ ) produced larger effect sizes. For BIS-11 at T1, per-protocol Cohen's  $d=0.56$  (95% CI 0.33–0.79). Session attendance correlated with magnitude of DIT-2 change in MRT ( $r= 0.34$ ,  $p=0.001$ ) but not in LST ( $r= 0.08$ ,  $p=0.36$ ).

Pre-specified moderation tests examined sex and baseline NSSI severity. There was no significant moderation by sex for primary outcomes (group  $\times$  time  $\times$  sex  $p>0.10$ ). Baseline NSSI severity moderated the effect on NSSI frequency such that participants with higher baseline frequency ( $\geq 6$  episodes past 12 months) showed larger absolute reductions in MRT (IRR = 0.54) than those with lower baseline frequency (IRR = 0.72); interaction  $p=0.03$ .



Safety monitoring identified no trial-related serious adverse events requiring hospitalization. Across both arms, 18 participants (7.5%) had adverse events related to increased distress requiring brief clinical contact;

distribution was similar across arms (MRT = 9; LST = 9). No differential increase in suicidal ideation was observed in either arm; mean PHQ-A suicidal ideation item scores decreased modestly in both groups.

**Table 5**

*Adverse events and safety outcomes*

Event type	Treatment	Count
Serious adverse events	MRT	0
Serious adverse events	LST	0
Distress requiring clinical contact	MRT	9
Distress requiring clinical contact	LST	9
Emergency referrals	MRT	2
Emergency referrals	LST	3
Study withdrawal due to distress	MRT	1
Study withdrawal due to distress	LST	2

All emergency referrals were managed per protocol and did not result in trial suspension.

Multiple imputation (20 datasets) under missing at random assumptions produced results consistent with primary MMRM analyses. Pattern-mixture sensitivity analyses assuming worse outcomes for missing participants attenuated but did not eliminate the MRT advantage (NSSI IRR at T1 under conservative assumptions = 0.74,  $p=0.02$ ).

#### 4. Discussion

The present study examined the comparative effectiveness of Moral Reasoning Training (MRT) and General Life Skills Training (LST) in reducing impulsivity and non-suicidal self-injury (NSSI) among adolescents, as well as the mediating role of moral reasoning in these outcomes. The findings demonstrated that MRT produced significantly greater and more durable reductions in both impulsivity and NSSI frequency compared to LST, with approximately half of these effects statistically mediated by improvements in principled moral reasoning. These results provide robust empirical support for the theoretical proposition that strengthening adolescents' moral-cognitive processing can attenuate impulsive self-injurious behaviors by enhancing deliberative control and value-based decision making.

The observed reduction in NSSI among adolescents receiving MRT aligns closely with contemporary socio-ecological and cognitive models of self-injury, which emphasize the interaction between individual cognitive vulnerabilities and proximal behavioral mechanisms (Prades-Caballero et al., 2025; Villacura-Herrera et al., 2025). Prior research has consistently identified impulsivity

as a critical proximal risk factor for NSSI, particularly in adolescents experiencing heightened emotional distress or psychiatric comorbidity (Muradian et al., 2025; Wei et al., 2024). The present findings extend this literature by demonstrating that impulsivity is not merely a static trait but a modifiable process that can be effectively targeted through interventions focused on higher-order moral cognition.

The superiority of MRT over LST in reducing impulsivity is theoretically consistent with dual-process models of reasoning, which distinguish between fast, automatic, affect-driven responses and slower, reflective, rule-based cognitive processes (Stanovich & West, 2000). MRT explicitly trained adolescents to slow down decision making, consider consequences for self and others, and evaluate actions in light of moral principles. This emphasis likely strengthened reflective control processes, thereby reducing reliance on impulsive coping strategies such as NSSI. In contrast, while LST improved general emotional and interpersonal skills, it did not explicitly target the evaluative processes that govern harm-related decision making, which may explain its comparatively weaker effects.

The significant gains in moral reasoning observed in the MRT group are consistent with decades of research demonstrating that moral judgment can be enhanced through structured dilemma discussion and guided reflection (Hao & Wu, 2019; Rest et al., 1999). Importantly, the present study advances this body of work by linking improvements in moral reasoning to clinically meaningful behavioral outcomes. Whereas previous studies have primarily examined moral reasoning as an educational or developmental outcome, the current findings demonstrate its

relevance as a mechanism of change in mental health interventions targeting self-harm.

The mediating role of moral reasoning provides a critical contribution to the literature on adolescent NSSI. Mediation analyses indicated that improvements in principled moral reasoning accounted for a substantial proportion of MRT's effects on both impulsivity and NSSI. This finding supports theoretical accounts suggesting that moral cognition shapes behavioral self-regulation by altering how individuals appraise urges, consequences, and personal responsibility (Rest et al., 1999; Villacís et al., 2023). Adolescents who increasingly evaluate self-injurious urges through a moral lens—considering harm, long-term impact, and alignment with personal values—may experience reduced subjective acceptability of NSSI, thereby weakening its reinforcing function.

These results also resonate with research linking moral reasoning deficits to other maladaptive behaviors, including bullying, cyberbullying, and delinquency (Daddis & Meadows, 2021; von Grundherr et al., 2017; Wang et al., 2016). Together, this evidence suggests that moral reasoning constitutes a cross-cutting cognitive factor influencing a range of externalizing and internalizing behaviors. The present study extends these associations to self-directed harm, highlighting moral reasoning as a potentially underutilized target in adolescent mental health interventions.

Behavioral task findings further corroborated the self-report outcomes, demonstrating that MRT participants exhibited greater improvements in inhibitory control and delay of gratification. These results are consistent with prior research linking reduced delay discounting to lower engagement in addictive and self-destructive behaviors (Jiang, 2024; Kirby et al., 1999). Importantly, the convergence of self-report, behavioral, and clinician-assessed outcomes strengthens confidence in the validity of the findings and reduces the likelihood that results are attributable solely to expectancy or reporting biases.

The maintenance of MRT effects at long-term follow-up is particularly noteworthy given evidence that many adolescent interventions yield short-term improvements that attenuate over time. Sustained reductions in impulsivity and NSSI suggest that MRT may produce enduring cognitive changes rather than transient behavioral suppression. This durability aligns with developmental models positing that adolescence is a sensitive period for shaping socio-cognitive processing, including moral and self-regulatory capacities (Blakemore & Mills, 2014). Interventions delivered during

this window may therefore have lasting impact by influencing the developmental trajectory of decision-making systems.

The findings also have important implications for adolescents with elevated clinical risk. Prior studies indicate that impulsivity and impaired decision making are particularly pronounced among adolescents with depressive disorders, trauma exposure, and ADHD, populations that also exhibit heightened NSSI risk (Birmaher et al., 1997; Kerbage, 2025; Nikolić et al., 2025). By targeting moral reasoning, MRT may offer a transdiagnostic intervention strategy capable of addressing shared cognitive vulnerabilities across diagnostic categories.

At a broader level, the present results contribute to emerging evidence that cognitive-moral variables play a central role in adolescent adjustment within both offline and digital contexts. Recent work has demonstrated that moral reasoning influences judgments and responsibility attribution even in technologically mediated environments (Leichtmann et al., 2024). Given the increasing role of digital stressors and online social dynamics in adolescent life, interventions that strengthen moral evaluation may be particularly relevant for contemporary youth.

## 5. Conclusion

Finally, the comparison with LST highlights an important distinction between general and mechanism-specific interventions. While LST produced meaningful improvements in emotional functioning, MRT yielded superior outcomes by directly addressing the cognitive mechanisms underlying impulsive self-harm. This finding supports calls for more theoretically grounded, mechanism-focused prevention programs that move beyond broad skill acquisition toward targeted cognitive change (Nwafor et al., 2024; Villacís et al., 2023).

## 6. Limitations & Suggestions

Several limitations should be acknowledged. First, although mediation analyses support the role of moral reasoning as a mechanism of change, causal inferences remain limited by the correlational nature of mediation modeling. Second, the sample was drawn primarily from school-based and community settings, which may limit generalizability to more severe clinical populations. Third, reliance on self-report measures for some constructs may introduce response biases, despite the inclusion of behavioral and clinician-rated outcomes. Finally, the study

did not include neurobiological measures, which could further elucidate underlying mechanisms.

Future studies should replicate these findings in more diverse and clinically complex samples, including adolescents receiving inpatient or intensive outpatient care. Longitudinal designs extending into young adulthood would help clarify the developmental durability of moral reasoning-based interventions. Experimental dismantling studies could identify which components of MRT are most critical for change. Incorporating neurocognitive and neuroimaging measures may further clarify how moral reasoning training influences brain systems involved in impulse control and decision making.

From a practical perspective, the findings support integrating structured moral reasoning modules into school-based mental health and prevention programs. Clinicians and educators may consider supplementing existing life skills curricula with targeted moral dilemma discussion and values-based decision-making exercises. Such integration could enhance the effectiveness of current interventions without substantially increasing resource demands, offering a scalable approach to reducing adolescent impulsivity and self-injury.

### Acknowledgments

We would like to express our appreciation and gratitude to all those who cooperated in carrying out this study.

### Declaration of Interest

The authors of this article declared no conflict of interest.

### Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

### Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

### Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

### Authors' Contributions

Sajedah Sharifi led the study conceptualization, intervention design, and overall project supervision, and coordinated clinical oversight of participant recruitment and assessment procedures. Saeed Doshmanfana managed trial methodology, randomization procedures, and data integrity, and contributed to the development of the Moral Reasoning Training manual. Fateme Yousefvand directed data collection, supervised facilitator training for both MRT and LST conditions, and ensured adherence to intervention fidelity protocols. Mahsa Teimouri conducted the statistical analyses, including mixed-effects modeling and longitudinal mediation, and contributed to interpreting outcome patterns across all follow-up intervals. Mona Khalednejad assisted with behavioral task administration, qualitative monitoring of participant safety, and drafting the results and discussion sections. All authors contributed to manuscript writing, critically revised the final document, and approved the completed version for publication.

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