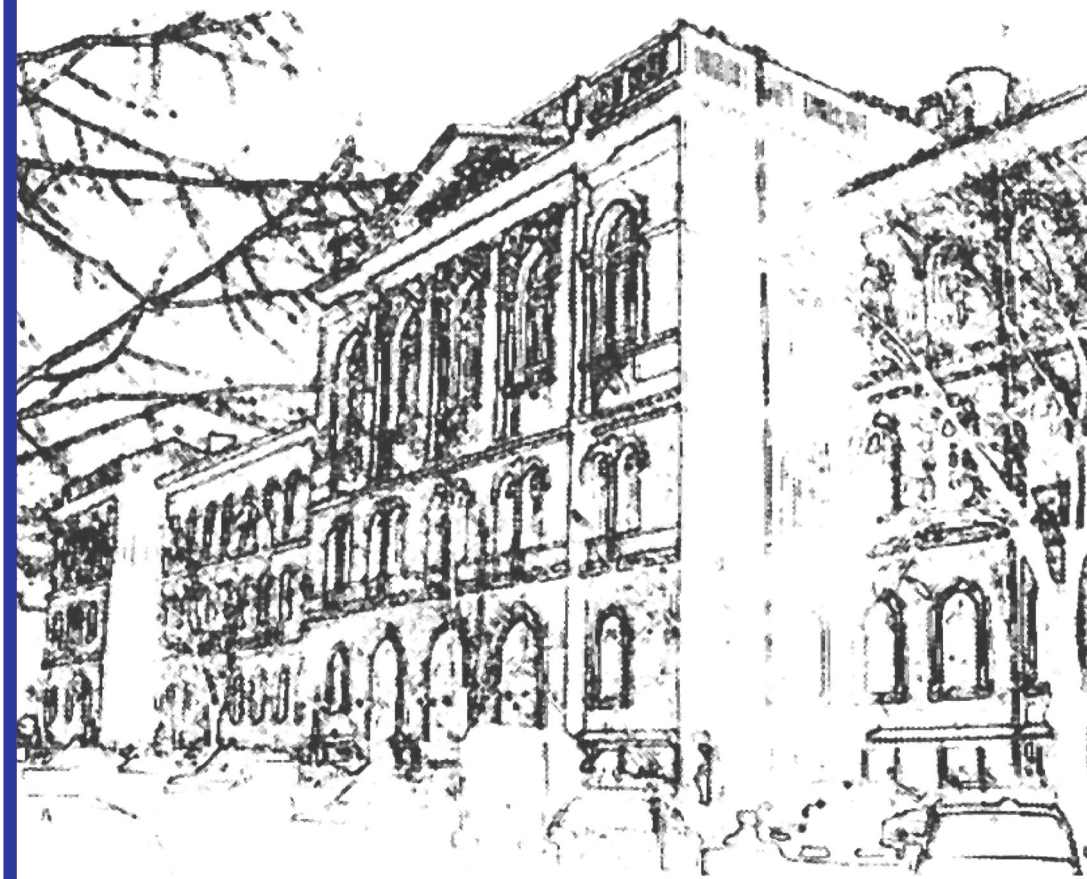
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HOW CAN I ENHANCE MY LIKEABILITY AMONG PEERS? A QUASI-EXPERIMENTAL STUDY ON SELF-DISCLOSURE IN INCREASING LIKEABILITY AMONG SOCIALLY ANXIOUS ADOLESCENTS

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Abstract

An important need in adolescence is belonging to a social group and being accepted by peers. Adolescents strive to augment their likeability within their social group to fulfill this need.

Aim. In the current paper, we sought to extend research on peer likeability ratings among socially anxious adolescents. We proposed self-disclosure as a potential strategy to increase peers' likeability ratings, especially for socially anxious adolescents. This sample included two groups: "peer rater" (N = 105) and "peer speaker", both pre-screened with the Social Interaction Anxiety Scale (SIAS). Different videos using speakers' self-disclosure were used to assess their likeability and desire for future interactions. Data were analyzed using ANOVA to examine significant differences in likeability ratings. In line with the adult literature, socially anxious adolescents are prone to receive lower likeability ratings. Findings showed that although socially anxious adolescents tend to receive lower likeability ratings from their peers than non-socially anxious adolescents, self-disclosure may turn these ratings in their favor. Theoretical and clinical implications are discussed.

Keywords: Social Anxiety, Early Adolescence, Self-disclosure, Likeability, Desire for future interaction

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Introduction

In social interactions, it is common for individuals to experience some level of discomfort or concern about how they are perceived. However, for those with Social Anxiety Disorder (SAD), this discomfort escalates into an overwhelming fear that persists across nearly all social situations, significantly impairing their ability to engage and interact.

Social anxiety disorder (SAD) develops in early to mid-adolescence, with an onset age around 13 years old (Fehm et al., 2008). SAD is characterised by an intense fear of negative evaluation in social situations, leading individuals to avoid social gatherings due to concerns about being judged (APA, 2013). Although most of the time this fear is irrational, research indicates that socially anxious individuals indeed are prone to receive lower likeability ratings from their peers, compared to their non-anxious counterparts (Voncken & Bögels, 2008).

In adulthood, individuals consider others' opinions but tend to show some resistance to peer influence. By contrast, during adolescence, this resistance is much lower, as young people are more vulnerable to social pressure. This often manifests as a tendency to conform to prevailing trends (Leigh & Clark, 2018).

When left untreated, social anxiety disorder (SAD) is considered a highly prevalent and disabling condition that can negatively affect several life domains. It may lead to poorer educational outcomes, reduced occupational functioning, difficulties in social interactions, lower relationship quality, and an overall diminished quality of life. Furthermore, SAD has been linked to suicidal thoughts, low self-esteem, lower socioeconomic status, unemployment, financial difficulties, and a higher likelihood of remaining unmarried. Despite these consequences, many individuals with SAD fail to recognize their symptoms as a mental health problem and therefore do not seek professional help (Iverach & Rapee, 2014). During middle childhood, these symptoms are less likely to disappear, suggesting that this developmental stage represents a critical period for prevention and intervention efforts (Steinsbekk et al., 2022).

The low likeability rates from others could result from their reduced collaborative efforts and joint actions (Günak et al., 2020). Additionally, their anxious speech patterns, delayed responses, limited speech, and ineffective social interactions make them appear less likeable and socially desirable, reducing their potential for forming friendships (Scharfstein & Beidel, 2014). Moreover, being disliked by others is amplified and even mediated by negative self-interpretation, a specific trait of SAD (e.g., Clark, 2005). Research suggests that rejection and social exclusion activate brain regions associated with physical pain, highlighting the intense emotional discomfort of social isolation (Eisenberger et al., 2003). All in all, this highlights the importance of peer acceptance and likeability in adolescents' psychological development.

Likeability is defined as "the degree to which an individual is liked and accepted by peers" (Hubers et al., 2016, p. 1444). Enhancing likeability can significantly improve social interactions for adolescents with SAD, as positive peer perceptions foster increased social support, which is vital for reduceing social anxiety symptoms (Baartmans et al., 2020).

The current study aims to explore how adolescents' self-disclosure—both positive and negative—and gender differences influence peer assessments of likeability, particularly among those with social anxiety. By understanding these dynamics, proper interventions may be developed to enhance social functioning and reduce the adverse effects of social anxiety in adolescence.

Theoretical Background

Social Anxiety

Early adolescence (10–14 years) is characterized by changes in biological, psychological, and social functioning, and a fundamental need for belonging to a peer social group (Brown, 2004). During this developmental stage, individuals shift from being primarily parent-dependent to becoming peer-dependent as they transition into adulthood (Bland & DeRobertis, 2017). This increased sensitivity to social dynamics and self-perception makes early adolescence particularly vulnerable to the onset of Social Anxiety Disorder (SAD), a time when concerns about body image, emotional expression, and social evaluation often emerge (Haller et al., 2015; Rapee & Spence, 2004).

Previous studies have shown that anxiety disorders are more common among girls than boys (Ohannessian et al., 2017), as girls are considered to be more vulnerable and they usually report greater fears related to authority (Beidel & Turner, 2005).

Adolescents with SAD often perceive social situations as hierarchical and competitive, emphasising their sense of inadequacy and fear of rejection (Dijk et al., 2018). They often struggle to form close friendships and romantic relationships, resulting in smaller social networks and a lack of supportive peer connections (Montgomery, 2005). In their attempt to secure a sense of belonging, they may adopt submissive behaviors, including conforming to peer mistreatment or avoiding confrontation, which may further augment their social anxiety (Bică, 2022; Gazelle & Ladd, 2003). Thus, they are more likely to form friendships with peers who share similar anxieties, leading to a mutually reinforcing pattern of social withdrawal and increased anxiety through co-rumination (Van Zalk et al., 2011). However, friends may serve as an indirect help for socially anxious adolescents to seek formal support (Alves et al., 2022). The long-term consequences of untreated SAD can be severe, with individuals at higher risk for educational underachievement, substance abuse,

depression, and other mental health issues in adulthood (Beidel & Turner, 2005; Brookman et al., 2022).

Cognitive models of SAD, while typically applied to adult populations, suggest that individuals with social anxiety tend to misinterpret how others perceive them, often underestimating their own likeability (Clark, 2005). Although these cognitive models have limitations in fully explaining SAD in younger populations (Halldorsson & Creswell, 2017), research consistently supports the notion that socially anxious individuals believe they are more disliked than is actually the case (Voncken & Dijk, 2013). Interestingly, individuals with low SA showed a pattern in which their sense of belonging continued to increase as socializing increased. In contrast, those with high SA experienced a satiation effect, whereby their sense of belonging ceased to increase after a certain level of social interaction (Hay et al., 2026). This distorted self-evaluation leads to withdrawal from social situations, exacerbating the cycle of social avoidance and maintaining symptoms of SAD (Miers et al., 2010). It is important to note that adolescents with SAD reported the greatest fear during formal performance situations, such as school presentations, followed by social interactions with others, and finally by being observed (Alves et al., 2022).

All in all, addressing this need for social affiliation of socially anxious adolescents in a positive and supportive way is critical for sustaining adaptive development during early adolescence (Bland & DeRobertis, 2017).

In conclusion, during early adolescence, adolescents become more sensitive to social evaluation, making them vulnerable to Social Anxiety Disorder (SAD), which involves a persistent fear of negative judgment in social situations. If untreated, SAD can lead to significant negative outcomes, highlighting the importance of supporting adolescents' social belonging. However, 65.7% of those diagnosed with SAD are willing to be provided with free psychological intervention for SAD (Alves et al., 2022).

Likeability

Likeability is defined as the amount of how much someone perceives us as friendly and collaborative (Cillessen & Marks, 2011). People high in agreeability (de Vries et al., 2020), physical attractiveness, intelligence, fashion sense, and athletic ability are considered more likeable (Brookman et al., 2022). Additionally, girls generally receive higher likeability ratings compared to boys (de Vries et al., 2020). Thus, these findings suggest that a combination of personality traits and social attributes play a significant role in shaping how individuals are perceived in social situations.

However, individuals with high levels of social anxiety may have difficulty in accurately estimating the quality of their social functioning, example, likeability (Baartmans et al., 2020). Specifcally, besides underrating their likeability ratings,

they tend to also underestimate the quality of their social appearance (Clark, 2005), social functioning (Verduin & Kendall, 2008), indicating a perception bias (Voncken & Bögels, 2008). Furthermore, these perceived low likeability ratings are thought to be a major factor in the persistence of SAD (Voncken & Dijk, 2013).

Moreover, likeability is strongly linked to social support networks, such as close friendships, which can alleviate symptoms associated with SAD. The presence of positive social interactions serve as a buffer against the negative outcomes of social anxiety, reinforcing the importance of likeability in mental health and social adjustment (Baartmans et al., 2020).

Self-disclosure

In this study, self-disclosure is conceptualized as a potential strategy for improving the likeability of socially anxious individuals, since there is limited research on how this strategy specifically functions among adolescents with SAD. Self-disclosure which involves "the act of revealing personal information about oneself to another" (Collins & Miller, 1994, p. 457), has been found to be a universal factor in increasing likeability (Voncken & Dijk, 2013). Gender differences in self-disclosure are noteworthy. Girls tend to increase their levels of self-disclosure earlier in adolescence compared to boys, who often begin to disclose more personal information later (Valkenburg et al., 2010). However, there may be a perceived risk for socially anxious girls, who fear that emotional self-disclosure might have a negative effect on their social status and their social support networks (Barnett et al., 2021).

An experiment conducted by Voncken and Dijk (2013) with first-year students found self-disclosure to be a significant predictor of increased likeability. Interestingly, socially anxious individuals may misinterpret the role of self-disclosure, assuming that revealing less about themselves is the key to social approval. This belief contrasts with findings that social connection and positive interactions, which increase the desire for future interactions, are often facilitated by self-disclosure (Mazziotta et al., 2011). However, previous studies support that socially anxious individuals often use an inverse relationship between self-disclosure and expected social outcomes. Thus, while those with lower levels of social anxiety tend to increase self-disclosure when they anticipate being liked, socially anxious individuals often disclose less when they expect to be accepted (Voncken et al., 2020). This reflects a protective strategy, as these individuals may fear that greater self-disclosure could lead to rejection. Yet, paradoxically, greater self-disclosure has been shown to improve likeability, as individuals who openly share personal experiences are often viewed more favourably by others (Collins & Miller, 1994). All in all, despite the general benefits of self-disclosure for likeability, the fact is that fear of rejection prevents socially anxious individuals from engaging in this behavior (Morrison et al., 2019).

Nevertheless, our study aims to align with these findings that underscore the importance of encouraging socially anxious adolescents to engage in more open social interactions, as this can enhance their likeability and alleviate some of the challenges associated with SAD (Voncken et al., 2020).

Study Relevance

Our study aims to fill an important research gap. The health and social repercussions of Social Anxiety Disorder have attracted substantial attention both in the public sphere and within medical and psychological academic discussions (Cheng & Yang, 2022).

Firstly, there are few experimental studies about how self-disclosure has an important role in increasing likeability for socially anxious adolescents. Secondly, the current data on social skills in nonclinical socially anxious youth remains inconsistent. Thirdly, there is limited research on peer evaluations of socially anxious adolescents by same-age peers (Miers et al., 2010).

These gaps are particularly concerning since social anxiety is one of the most common anxiety disorders which, despite its prevalence, often goes undiagnosed during adolescence due to a lack of awareness about its symptoms (Beidel & Turner, 2005). Additionally, while adult social anxiety has been well-studied, research investigating the social mechanisms of anxiety in adolescents remains limited (Halldorsson & Creswell, 2017). Focusing on this is relevant given the significant amount of time adolescents spend in peer groups, so peer relationships hold a great importance for them (Brown, 2004). During this time, the intense fear of negative evaluations and sensitivity to peer evaluations becomes particularly pronounced, with social anxiety often emerging in the early to mid-teen years (Haller et al., 2015; Rapee & Spence, 2004).

All in all, by focusing on peer evaluations of likeability among socially anxious adolescents, our study contributes to a better understanding of how to improve likeability and reduce social anxiety's impact on peer relations during a fundamental social developmental stage. Given the role of peer interactions in shaping social functioning, findings from this research could inform interventions aimed at improving the social outcomes of adolescents with SAD, These findings may have important practical implications. Encouraging appropriate self-disclosure may help socially anxious adolescents improve peer likeability and social integration. In school settings, structured activities that promote safe interpersonal sharing (e.g., group discussions, collaborative projects, or peer-support programs) could support positive peer interactions. In therapeutic contexts, incorporating self-disclosure exercises into interventions for Social Anxiety Disorder may help adolescents challenge negative beliefs about social evaluation and develop more

adaptive social behaviors. Schools should focus not only on recognizing adolescents at risk but also on offering a variety of interventions customized to their specific needs, guiding them toward positive developmental outcomes (Alves et al., 2022).

Overview of the present study

The aim of this study is to explore early interventions that may reduce the effects of social anxiety during adolescence by promoting self-disclosure, thereby increasing peer likeability. First, we hypothesize that increased self-disclosure by socially anxious individuals will result in higher likeability ratings from peers, as well as a greater desire for future interactions. Second, we expect that non-anxious adolescents will demonstrate higher levels of likeability and desire for future interactions compared to their anxious counterparts.

Our research addresses two key questions: (1) Does self-disclosure play a crucial role in enhancing likeability and the desire for future interactions in socially anxious adolescents? (2) Are socially anxious adolescents more likely to receive lower likeability and desire for future interaction ratings from their peers? Additionally, considering that (a) social anxiety influences social decision-making (Bică, 2022), (b) socially anxious individuals often exhibit a perception bias (Voncken & Bögels, 2008), (c) these individuals frequently receive lower likeability ratings from peers (Beidel & Turner, 2005), and (d) they tend to select friends with similar anxiety disorders (Van Zalk et al., 2011), we also explore whether the social anxiety levels of evaluators impact their ratings of likeability for both anxious and non-anxious speakers.

Thus, this study hypothesizes that:

H1. Self-disclosure increases likeability and desire for future interaction among socially anxious adolescents.

H2. Socially anxious adolescents are more likely to receive lower likeability ratings and less desire for future interaction from their peers.

To examine these hypotheses, we conducted a quasi-experiment in which the likeability ratings of socially anxious adolescent speakers were measured across four stages: (T1) based on a photograph, (T2) after a brief personal introduction, (T3) following positive self-disclosure, and (T4) following negative self-disclosure. Self-disclosure was progressively increased from T3 to T4, following a scripted format, and likeability ratings were assessed after each stage. Based on existing literature, we expect the likeability ratings to increase across the four stages.

Building on prior research (Miers et al., 2010; Verduin & Kendall, 2008), we selected unfamiliar peers of a similar age as evaluators, to minimize the influence of social reputation on peer ratings (Hymel et al., 1993). Following Miers et al. (2010), we chose this approach because it more accurately reflects the everyday

social experiences of anxious and non-anxious adolescents, compared to studies that utilize adult observers.

Method

Permission to undertake the study was provided by the University Human Research Ethics Committee and Department of Education.

Data and Sample

The sample consisted of 105 evaluators (n = 55 girls) aged 12–15 years (M = 13.42, SD = .92), and 4 speakers – 2 boys and 2 girls - (M = 13.74, SD = 1.25). Peer speakers attended the same education levels as evaluators and were of comparable age. Roughly 78% of the evaluators came from a two-parent family and 21.9% from a single-parent family; 56% have no siblings; 40% reported having between 1–5 friends and 48.5% more than 15 friends. The pre-screening for social anxiety was performed with the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) by the school counselor and a clinical psychologist. SIAS scores of the evaluators showed considerable variation (M = 30.50, SD = 13.07, range 4–64). The cut-off score to discriminate between clinical and non-clinical cases was 36, according to the author of the scale (Peters, 2000). Therefore, in the main group (evaluators), 31.4% of participants had a score higher than 36 (Heinrichs & Hofmann, 2001), which is within the clinical range.

The informed consent from all participants (speakers and evaluators) - adolescents and their parents – was gathered before the beginning of the study.

Exclusion criteria were defined to minimize potential confounding factors. Specifically, participants who were already familiar with any of the speakers were not included; all raters confirmed they had no prior acquaintance with the speakers. In addition, participants with incomplete data or who did not follow study instructions would have been excluded, although in this study no participants met these exclusion criteria.

Measures

Social Anxiety

The level of social anxiety was assessed by SIAS (Social Interactions Anxiety Scale). SIAS is a 20-item self-report scale (on a 1–5 Likert Scale) designed to measure social interaction anxiety, defined as "distress when meeting and talking

with other people" (Mattick & Clarke, 1998, p. 457). The scales items are conformed with the DSM-III-R descriptions of Social Phobia - Circumscribed and Generalised types and have a robust internal consistency ($\alpha = .94$) and test-retest reliability (4 weeks, $\alpha = .92$) (Mattick & Clarke, 1998). Overall, previous studies show good internal consistencies comparable to the original version (e.g., Voncken & Dijk, 2013).

Likeability

The level of likeability was assessed by two different measures. First, we use the *Likability Scale* (Reysen, 2005) which aims to measure the perceived likability of a target individual. It has 11 items and 1–7 Likert scale responses. The second scale was *Likeability Ratings* (Desire for Future Interaction, DFI, Coyne, 1976). This scale measures the willingness to engage in future interactions with someone (e.g., whether one would like to meet that person, ask her/him for advice, or sit next to her/him on a 3hr bus drive (Coyne, 1976). The DFIS consists of 13 items rated on a 5-point scale.

Procedure

The experimental process consisted of two phases, detailed extensively in the experimental settings section and illustrated in the Figure 1 and 2 (Appendix). To maintain experimental control, the procedure followed a fixed sequence across conditions. Four adolescents performed the self-disclosure task, with non-socially anxious speakers presenting first, followed by socially anxious speakers. All participants received the same instructions and completed the task under standardized conditions to ensure consistency across presentations. Thus, all speaker recordings were standardized to minimize potential confounding variables. Recordings were conducted in the same room, with a plain white wall as the background and no decorative elements. While minor natural variations in delivery could not be fully controlled, these steps were implemented to ensure that differences in evaluator ratings were attributable primarily to the experimental manipulation rather than extraneous factors.

Broadly, in the recording phase, the speakers were photographed and recorded onto digital video. Based on the interaction between gender and anxiety/non-anxiety conditions, we implemented the data in JASP using the following categories: Condition 1 (non-anxious boy), Condition 2 (non-anxious girl), Condition 3 (anxious boy), and Condition 4 (anxious girl). Secondly, in the next phase, the peer evaluators rated speakers' likeability using Likeability Scale and Desire for future interactions. Specifically, participants started to look to the

computer screen and evaluated the materials regarding each speaker, and filled out the questionnaires (DFI, and Likeability Scale). This procedure is similar to Voncken et al. (2020).

Although the study involved digital video stimuli, participants completed the Likability and Desire for Future Interaction (DFI) scales using a paper-and-pencil format. This approach was chosen to increase accountability and careful responding, particularly given the adolescent sample. After viewing each video, participants completed the scales at their own pace before proceeding to the next video. All responses were later entered into a computer for analysis, ensuring consistency and accuracy of the data.

Experimental setting

The "peer speaker" group. The "peer speaker" target consisted of four adolescents - two boys (one socially anxious and one non-socially anxious) and two girls (one socially anxious and one non-socially anxious) - pre-screened with SIAS by a clinical psychologist. To ensure that the speakers and raters did not know each other, the four speakers were recruited from a different school located in a neighbouring town. Post-test, we made sure that the adolescents had no previous interactions. In doing so, we excluded the possibility that participants from the main group previously knew the adolescents from the peer speaker group (according to Voncken et al., 2020).

The rating tasks (T1-T4). To assess the speakers' level of likeability and desirability, different sets of videos from the speaker group were used. First of all, speakers gave us written consent to take and save passport-type photos (T1), to be recorded while sharing a general description of themselves (T2), to reveal a positive school experience (T3), and to reveal a negative school experience (T4). They were recorded by the school counselor and another teacher so they were in a familiar setting with familiar people, reducing the possibility for increased anxiety levels. Speakers have given permission for the speech recordings to be used for research purposes.

In the present study, adolescents were given the freedom to describe their experiences in their own words. They were provided only with a general topic (e.g., describing a pleasant experience at school), while the specific content and level of detail were left to their discretion. This approach was chosen to preserve the spontaneity and ecological validity of the interaction, as it more closely resembles how self-disclosure occurs in everyday social situations. Therefore, the emotional weight of the stories in T3 and T4 was not artificially balanced, since the aim was to capture natural variations in how adolescents choose to share personal experiences.

Data shows that such brief clips, or "slices" of behavior provide sufficient information for accurate judgments of personality traits (Carney et al., 2007). In addition, possible social skills deficits could be captured without being influenced

by anxiety arising as a result of engaging in an unexpected, spontaneous speech task. Furthermore, the lack of audience interaction prevented the possibility of the socially anxious speakers' ability to perform skilfully being affected by negative feedback (Miers et al., 2010).

In the evaluation phase, the evaluators (N = 105) were welcomed in the experimental room. They were seated in chairs with an angle of 45° facing each other and placed in front of a computer screen on which the pictures and recordings of the peer speaker target were shown (similar to Voncken et al., 2020). A picture of each participant was first displayed (T1), followed by a brief video in which they introduced themselves (name, age, class, hobbies, family, and number of siblings) (T2), and finally, a brief video in which they disclosed a happy experience that occurred in their favorite class at school (T3) and then disclosed a sad school experience (T4). Each phase (T2, T3, T4) lasted for roughly one minute in length, after which the peer group had to rate the likeability level of each of the 4 adolescents in the video group (approximately 7 -10 minutes).

The purpose of this specific seating arrangement was to simulate a natural social environment, allowing participants to interact or be observed in a way that closely resembles real-life peer interactions. This setup helps ensure that responses and social behaviors are more ecologically valid, reflecting how socially anxious adolescents might behave in everyday social settings.

Data analyses and power analyses

Analytic plan

The relationship between the variables in the model was tested by ANOVA 4 groups and 4 repeated measures (mixed design) and ANCOVA.

Power analyses

We estimated our effect size based on previous studies. Thus, prior data found a medium size effect for the relationship between social anxiety and likeability (e.g., Voncken et al., 2010; Voncken & Dijk, 2013), and the effect size of the relation between self-disclosure and social anxiety varies from medium to high (Voncken & Dijk, 2013). Combining these findings, we used medium effect sizes for the power analyses. The sample size was informed by an a priori analysis of power (G-power) which determined that the minimum number of participants required to achieve a statistical power of .80 and detect an effect size of .25, we needed a minimum of 100 participants.

A priori power analysis and sample size estimations are essential for ensuring sufficient statistical power in designs using repeated measures ANOVA,

which can detect effects more efficiently than purely between-subjects designs due to reduced residual variance when subjects serve as their own control (Potvin & Schutz, 2000). Power analysis for repeated measures models demonstrates that the required total sample size depends on the *effect size*, *number of measurements*, and *correlation among repeated measures* rather than on the absolute number of participants alone, with typical behavioral studies often achieving adequate power with sample sizes in the low hundreds for medium-sized effects (Brysbaert, 2019). Because repeated measurements and within-subject factors increase sensitivity to detect effects, moderate sample sizes such as 105 evaluators can be sufficient to identify theoretically meaningful effects in mixed designs when medium or larger effects are anticipated, especially when proper estimates of correlations and effect sizes are incorporated into the planning process (Brysbaert, 2019; Potvin & Schutz, 2000).

Results

First, it is expected that: Self-disclosure helps in increasing likeability and desire for future interaction in anxious adolescents (H1). Second, we stated that: Anxious adolescents are prone to receiving low ratings from their peers regarding likeability and desire for future interaction (H2).

Self-disclosure and likeability

First, we examined variations in likeability ratings across anxiety-related self-disclosure conditions using a mixed-design repeated-measures ANOVA. Situation (photo, general information, positive self-disclosure, negative self-disclosure) and speaker type (non-anxious boy, non-anxious girl, anxious boy, anxious girl) were included as within-subject factors, and participant gender as a between-subject factor. Because the assumption of sphericity was violated, Greenhouse–Geisser corrections were applied. The analysis revealed no significant effect of social anxiety on likeability ratings, $F(2, 105) = 0.65$, $p = .536$.

However, the interaction between the gender and the anxiety/non-anxiety condition of the speakers produced a difference in perceived likeability $F(6, 105) = 15.13$, $p < .001$, $\eta^2 = .01$. Thus, in the first scene (T1), after we displayed a photo of each of our speakers, the non-anxious ones obtained the higher level of likeability, especially the non-anxious girl. In contrast, the anxious adolescents were less liked by their peers, especially the anxious girl. In the second scene (T2), after the four adolescents described themselves generally, the non-anxious girl again obtained the highest level of likeability, followed by the anxious boy, then by the non-anxious

boy, and lastly by the anxious girl. After the speakers shared a positive experience from school (T3), the non-anxious girl registered the highest level of likeability, followed by the anxious boy, then by the non-anxious boy, and in the end by the anxious girl. In the last scene (T4), after we introduced negative self-disclosure, we obtained similar results to T3. Hence, overall, the non-anxious girl obtained the highest level of likeability, but the anxious girl obtained the lowest level of likeability. Unfortunately, self-disclosing did not help our anxious girl to be perceived more liked by her peers. Is mandatory to mention that these results are based on a single female speaker and should be interpreted accordingly. However, positive self-disclosure helped the anxious boy obtain a modest raise in his likeability ratings. So far, even if our first hypothesis does not confirm, our results show that according to H2, the anxious adolescents are indeed less liked by their peers. The results are displayed in Table 1. Figure 4 presents a visual description of these differences.

Post-hoc comparisions indicated that the non-anxious boy was significantly less liked compared with the non-anxious girl (M = - 7.70, SD = 2.12, $p < .001$), but liked more than the anxious girl (M = 13.12, SD = 2.12, $p < .001$). Furthermore, the non-anxious girl was liked more than the anxious boy (M = 8.29, SD = 2.12, $p < .001$), and liked significantly more than the anxious girl (M = 20.82, SD = 2.12, $p < .001$). Nonetheless, the anxious boy was significantly liked more than the anxious girl (M = 12.52, SD = 2.12, $p < .001$).

Self-disclosure and desire for future interactions

Second, we tested the variations in desire for future interactions ratings under anxiety conditions involving self-disclosure. We found no main difference of self-disclosure in social anxiety across gender x our 4 situations $F(2, 105) = 1.59$, $p = .200$ upon the speaker group, having to mention that since the sphericity is violated, we reported the Greenhouse-Geisser ε. Similar to previous likeability data, the interaction between gender and the anxiety or non-anxiety condition affected the level of desire for future interactions $F(7, 105) = 10.01$, $p < .001$, $\eta^2 = .01$.

Following T1 (photo exposure), the non-anxious girl was assessed with a higher level of desire for future interactions, followed by the non-anxious boy, the anxious boy, and the anxious girl. The hierarchy is relatively similar after presenting themselves (T2), therefore the non-anxious girl was assessed with a greater level of desire for future interactions, followed by the non-anxious boy, the anxious boy, and then the anxious girl. After expressing a positive experience from school (T3), the non-anxious girl was assessed with a higher level of desire for future interactions, followed by the non-anxious boy, then the anxious boy and the anxious girl. After expressing a negative experience from school (T4), we obtained similar results to

T3. Similar with the results mentioned above, the non-anxious girl was the most desired for future interactions, but the anxious girl less desired. Unfortunately, self-disclosing did not helped nor our anxious girl or anxious boy to be perceived more desired by their peers. However, his general description helped the anxious boy obtain a slight raise in his desire ratings, and comparing with first impression - T1 (photo), self disclosure determined a raise in his desire ratings. So far, even if our first hypothesis does not confirm, our results show that according to H2, the anxious adolescents are indeed less desired by their peers. The results are displayed in Table 1. Figure 2 presents a visual description of these differences.

Post-hoc comparisions indicated that the non-anxious boy was significantly less desired for future interactions compared with the non-anxious girl (M = - 7.15, SD = 1.70, $p < .001$), but more desired for future interactions than the anxious girl (M = 8.56, SD = 1.71, $p < .001$). Furthermore, the non-anxious girl was desired more than the anxious boy (M = 8.92, SD = 1.71, $p < .001$), and desired significantly more than the anxious girl (M = 15.71, SD = 1.71, $p < .001$). Nonetheless, the anxious boy was desired more than the anxious girl (M = 6.79, SD = 1.71, $p < .001$).

Likeability and desire for future interactions ratings when respondents' anxiety is under control

In addition to the hypothesis-driven analyses, we conducted an exploratory analysis to examine whether the patterns observed in likeability and desire ratings remained when participants' anxiety levels were statistically controlled.

ANCOVA was used to assess the effect of the main group (N = 105) on desire and likeability when raters anxiety was statistically controlled. This approach allowed us to reduce error variance associated with individual differences in anxiety and to obtain a more accurate estimate of the group effect.

Significant group differences were observed across all four time points. At T1 (photo), both desire for future interaction (F = 23.87, $p < .001$, $\eta^2 = .15$) and likeability (F = 23.19, $p < .001$, $\eta^2 = .14$) differed between groups. A consistent pattern emerged at T2–T4 (general information, positive and negative self-disclosure), with significant differences in desire (Fs = 20.84–32.31, $ps < .001$, η^2 = .13–.19) and likeability (Fs = 26.16–36.27, $ps < .001$, η^2 = .15–.20). Across all time points, the non-anxious girl was rated highest, the anxious girl lowest, and the non-anxious and anxious boys generally fell in between. These results indicate a robust pattern in which speaker anxiety and gender influenced participants' desire for future interaction and likeability, with positive evaluations consistently favoring the non-anxious girl and negative evaluations accumulating for the anxious girl.

Discussion

The purpose of this study was to provide more insight on how self-disclosure may impact the perception of likeability. During our quasi-experiment, the desire for future interactions and likeability level of anxious and non-anxious adolescents were measured in four stages. We also took a closer look at gender differences, and at the likeability and desire ratings when respondents' anxiety is under control. The results can be summarized as follows;

Even if anxious adolescents were less liked and less desirable for future interactions than the non-anxious ones, however, the interaction between gender and the anxiety or non-anxiety condition of our speaker group produced a difference in their likeability and desire for future interaction ratings. Considering adult literature (Baartmans et al., 2020; Voncken et al., 2008, 2010), our results confirm a strong pattern of lower likeability ratings among socially anxious individuals, regardless of age. These findings are in line with sociological studies which have consistently indicated that socially anxious are highly disliked (Greco & Morris, 2005). Socially anxious adolescents who focused primarily on concerns about negative evaluation tended to underestimate how much their peers liked them. In contrast, adolescents with pronounced social avoidance showed a more realistic view of their likeability and friendships, as they were generally less liked by peers and had fewer friends (Baartmans et al., 2024). Furthermore, previous data (e.g., Barrow et al., 2011; Verduin & Kendall, 2008) explain how an anxiety disorder undoubtedly leads to negative peer likeability. Therefore, there may be some truth to such fear of social rejection since individuals with social anxiety are indeed often evaluated negatively in social situations (Voncken et al., 2008, 2010). Moreover, it seems that same-age peers are very quick to perceive (within 2 minutes) the social skills difference between high and low socially anxious adolescents (Verduin & Kendall, 2008).

Closer examination may explain these low likeability ratings experienced by anxious adolescents. For instance, Miers and colleagues (2010) mention a general lack of social skills (such as posture and body movement), and the safety (interfering) behavior (such as speaking rapidly to avoid awkward pauses or maintaining a very static posture to prevent body shaking). In fact, according to Gazelle and Ladd (2003), socially anxious individuals tend to be disliked because of their behavior signal submission. Besides, the perception of lacking athletic and 'without style' may lead to being excluded from peer activities (Hymel et al., 1993). Furthermore, attractiveness plays a key part by being a stronger predictor of peer liking than the adolescent's anxiety (Brookman et al., 2022). Thus, socially anxious adolescents may be perceived as less attractive compared to low socially anxious adolescents (Miers et al., 2010). Generally, individuals with social anxiety are found to be less liked and judged more harshly in terms of physical attractiveness than non-anxious ones (Barrow et al., 2011). However, our study did not measure how

attractive our socially anxious are perceived by their peers and how it might had influenced their likeability ratings.

Brookman and colleagues's results (2022) differ from our findings by stating that for instance, early adolescent girls with SAD are more liked, pitied, less feared, and less discriminated by their peers (in terms of desire for social interaction) than those without SAD. Furthermore, in an experiment conducted by Voncken and colleagues (2020), highly socially anxious individuals were considered as likeable as their low socially anxious peers. Thus, social anxiety may create prejudice in perceived likeability, and its balancing between objective and subjective likeability can be the key to social anxiety treatment. These discrepancies may reflect methodological and contextual differences, as well as distinctions between objective ratings and subjective peer perceptions. Overall, this suggests that social anxiety interacts with both situational and perceptual factors, and understanding this balance may be key to designing effective interventions for adolescents with SAD.

However, in order to increase these liking ratings, adolescents who struggle with social anxiety need to be well-motivated and engage in certain behaviors (de Vries et al., 2020). Decreasing observable anxiety and improving social skills may be a solution to increasing peer likeing (Barrow et al., 2011). Moreover, in line with our hypotheses, we found that self-disclosure increased likeability and desire for future interactions ratings, but only for the anxious boy from our study. Furthermore, expressing positive and negative experiences produced an improvement in terms of likeability and future interactions, especially for the non-anxious girl speaker. Therefore, the transition from sharing general personal information to revealing positive school experiences may increase the level of likeability and desire for future interactions for socially anxious speakers. This sentence can be stated based on the observed patterns; however, it represents an advanced interpretation rather than a direct reporting of the data. It extands beyond the immediate results by proposing a possible mechanism linking the type of self-disclosure to changes in likeability and desire for future interactions among socially anxious speakers. In line with our findings, in an experiment conducted by Voncken and Dijk (2013), self-disclosure predicted increased likeability. These results can be explained by the fact that self-disclosure is universal to likeability and is also a fundamental part in building a friendship since it leads through the level of intimacy from strangers to close friends. Generally, revealing positive information increases the likelihood of making a good impression and this fact may explain why sharing a positive experience helped both our anxious and non-anxious speaker boy be perceived as more likeable. Rains and Brunner (2018) proved that people who share positive personal information tend to be liked more by others, particularly when the relationship is not close. Yet, the socially anxious girl from our study had a low likeability linear rate during our four experimental stages, mainly when she made a negative self-disclosure. Thus, a more detailed investigation is required to clarify these mixed results and answer the question of why the socially anxious scored low on likeability, especially when data

shows gender differences in terms of likeability, with girls being perceived more likeable than boys (de Vries et al., 2020). Perhaps because they are also more susceptible to social anxiety, so more likely to receive low likeability ratings (Beidel & Turner, 2005)?

However, it is known that people generally make rapid and stable judgments regarding subjective traits like likeability (Willis & Todorov, 2006). Maybe if our speaker group had been permitted more time to disclose personal experiences, our results might have been different. There is evidence showing that socially anxious people are disliked less after getting to know one another with interactions lasting 5 to 10 minutes (Voncken et al., 2008), but however, it is also possible that they are disliked by others from the very beginning.

Looking at our findings, we can easily see they are compatible with cognitive theories of adolescence social anxiety that report a negative relationship between the level of anxiety and negative perceptions and interpretations related to their anxiety (Spence & Rapee, 2016). A possible explanation of our overall results may be the fact that in general, previous data that found skills deficits used clinical samples of social anxiety while studies that did not find deficits used highly socially anxious adolescents derived from a normal population (Miers et al., 2010). Consequently, inconsistent findings may be specific to nonclinical samples of socially anxious adolescents. Besides, the social task we used was semi-structured, as the participants received explicit instructions about the topic as also having the autonomy to choose what to share specifically and to what extent, and furthermore, they were not confronted with unexpected questions. Previous studies have explored how the structure level of a social context may impact the behaviors of socially anxious individuals. Thus, using less structured tasks may have a strong negative effect on self-disclosure by decreasing its level (Voncken & Dijk, 2013). In contrast, more recent research found that in a structured social context, socially anxious individuals do not show marked reductions in likeability, but have a cognitive bias toward their anticipated negative evaluation (Voncken et al., 2020).

Theoretical and clinical implications

In trying to replicate previous findings according to which adult individuals with social anxiety tend to receive lower likeability ratings from their peers (Baartmans et al., 2020; Voncken et al., 2008, 2010), our results suggest a solid pattern of lower likeability ratings among socially anxious individuals, regardless of age. Since previous research has shown that having positive and supportive interactions with peers is crucial due its protective effect (Baartmans et al., 2020), our findings aim to encourage socially anxious adolescents to share more with their peers in order to be perceived as more likeable. Plus, it seems that among participants

diagnosed with social anxiety disorder (SAD), 65.7% indicated that they would be willing to receive free psychological intervention (Alves et al., 2022). This finding highlights a general openness among adolescents with SAD to engage in support services, suggesting that accessible interventions could reach a substantial part of this population.

Based on cognitive theories, socially anxious adolescents should engage in controlled exposure, such as support groups, to help break the cycle of negative social experiences or lack of positive interactions, which lead to negative thoughts and interpretations about social functioning (Spence & Rapee, 2016). This cycle often results in social avoidance and delayed social skill development, further exacerbating social anxiety (Greco & Morris, 2005). Repeated social avoidance may limit opportunities for socialization and contribute to social skill deficits over time (Greco & Morris, 2005). Furthermore, socially withdrawn adolescents may receive less favorable peer evaluations, including lower likeability and popularity (Henricks et al., 2023).

Nonetheless, since self-disclosure can help socially anxious adolescents increase their likeability and encourage future interactions with peers, sharing a positive school experience - a conversational topic that isn't too personal - can provide a sense of safety during self-disclosure. This approach may serve as a starting point for bonding and building deeper relationships. Schools provide a natural setting to observe and address social anxiety, and should therefore be viewed as holistic environments where staff are aware of how to identify vulnerable students, support them in coping, and connect them with appropriate interventions.Since children spend a significant time of their time at school, in social context, teachers should be trained to recognize signs of social anxiety (Alves et al., 2022).

Limitations

This study is not without limitations. First of all, we did not have full control over the self-disclosure of the speakers and this may explain our mixed results. Specifically, our speakers were not required to follow a script during T2 to T4; they were simply invited to share some personal information (T2), and then a positive (T3) and negative school experience (T4), and from this point on, they had the freedom to decide the extent of their sharing. Second, a larger sample would have been beneficial for both the raters and the speakers. However, other factors may have a key role in determining the degree of likeability, such as perceived similarity (Voncken et al., 2008) or attractivity (Brookman et al., 2022). Also, even if previous research showed some differences between girls and boys in terms of social anxiety and peer difficulties (Greco & Morris, 2005), our sample size could not permit a deeper analysis of gender effects, as our anxiety/non-anxiety condition and gender

differences had only one 'representative' (e.g., one anxious girl). Furthermore, we can not account for possible framing effects attributed to the stimuli's presentation order (presentation order was counterbalanced across conditions)./ Another limitation of the present study is that inter-measure dependencies were not explicitly accounted for in the analyses. Treating repeated measures as independent may have influenced effect size estimates and significance levels. Future studies should consider using multilevel or other statistical approaches that account for within-participant dependencies to provide more accurate results. Although schools are effective for identifying adolescents with SAD, other contexts should also be considered.

Future research

There is an opportunity for future research to consider mixed-method approaches (e.g., vignettes) to further examine the relationship between likeability, self-disclosure, and social anxiety in early adolescence and the potential benefits of promoting self-disclosure in social anxiety, given how counterintuitive it is for them to engage in doing so. Future research could therefore explore the role of internal motivations in engaging in being more open about personal experience and self-disclose. It is acknowledged that participants' responses to peer self-disclosure may not mirror their actual behavioral responses in real-life social situations. In this way, the use of technology, such as 3-D virtual reality, could be very valuable and provide additional information.

However, a larger sample size would allow to conduct a subgroup analysis. It is also interesting to explore how the expectation or perception of being liked or disliked may influence social youth's approachability or openness tendencies compared to nonsocial peers.

Schools serve as key settings for the identification and management of mental health issues in children and adolescents. Implementing prevention or intervention programs within schools represents a critical mental health strategy, as it can provide effective support to communities that are often under-diagnosed and have limited access to treatment. School-based initiatives can also enhance mental health literacy among educators, parents, and caregivers, facilitating earlier and more accurate recognition and referral of conditions such as SAD (Laldinpuii et al., 2024). Given these potential benefits, future research could explore school-based interventions from a community-focused perspective, considering parents, teachers, students, and other school personnel as active contributors to positive change (Alves et al., 2022).

Nonetheless, it may be relevant to identify if sharing other different personal information (e.g., hobby, love life) may raise likeability and desire for future

interactions. Previous studies show that the level of desire for future interactions increases when a person identifies socially or if they have someone with whom they maintain a positive interaction (Mazziotta et al., 2011). To clarify the effects and perceptions of likeability and social anxiety, it would be relevant to carry out a longitudinal study exploring the role of self-disclosure, in which adolescents are monitored from an age that temporally precedes the onset of social anxiety.

Ultimately, a community-based approach may improve social functioning, interpersonal relationships, and academic success, leading to better mental health outcomes for vulnerable adolescents (Alves et al., 2022).

All in all, the findings of the present research produce a compelling puzzle - what is the origin of low likeability and desire for future interactions ratings among socially anxious adolescents?

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Appendix

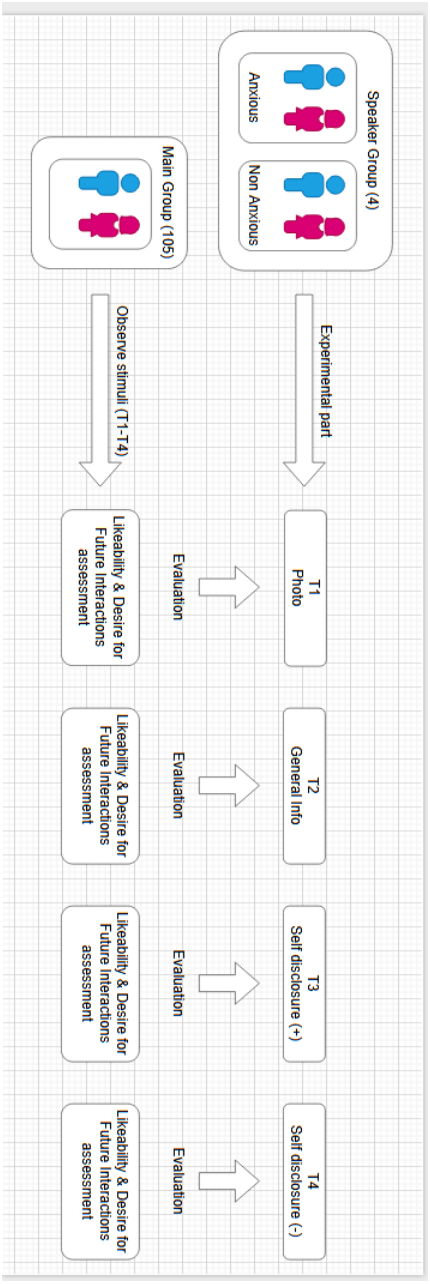


Figure 1. Experimental steps

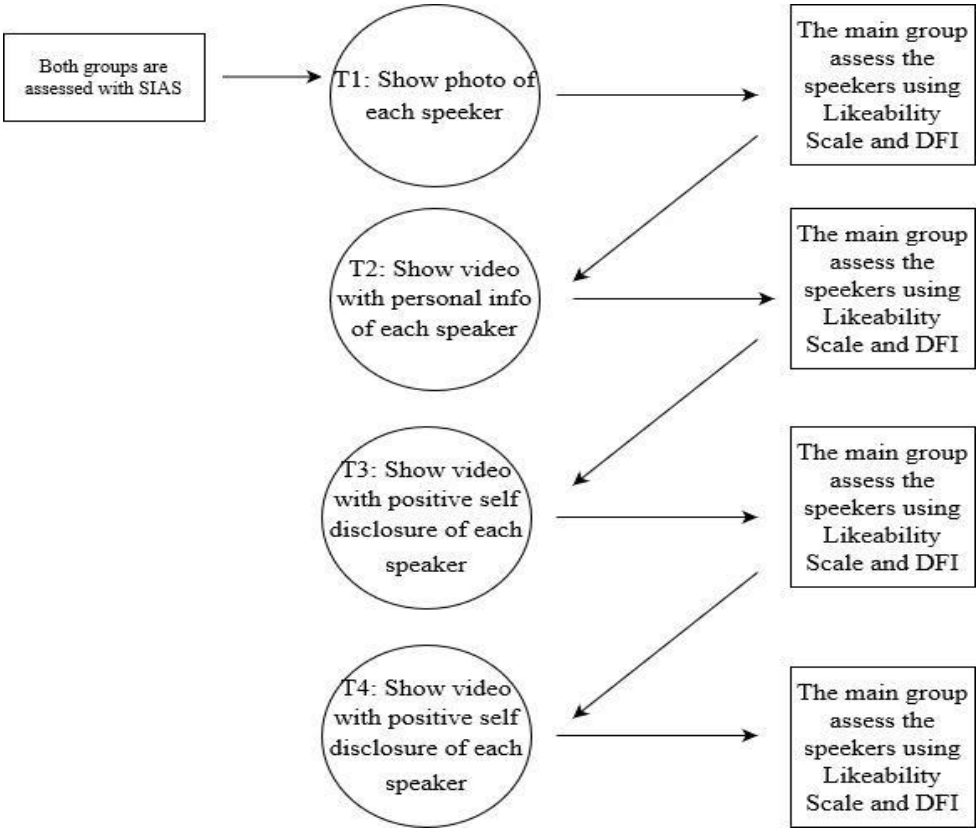

Both groups are assessed with SIAS
T1: Show photo of each speeker
T2: Show video with personal info of each speaker
T3: Show video with positive self disclosure of each speaker
T4: Show video with positive self disclosure of each speaker
The main group assess the speekers using Likeability Scale and DFI
The main group assess the speekers using Likeability Scale and DFI
The main group assess the speekers using Likeability Scale and DFI
The main group assess the speekers using Likeability Scale and DFI

Figure 2.

Table 1. Likeability and Self-Disclosure Scores

	T1: Photo				T2: General Info				T3: Positive self-disclosure				T4: Negative self-disclosure			
	Like		Desire		Like		Desire		Like		Desire		Like		Desire	
	M	*SD*		*SD*		*SD*		*SD*		*SD*		*SD*		*SD*		*SD*
Condition 1	43.61	11.05	36.62	10.34	44.27	15.37	38.10	11.99	45.39	14.36	37.83	11.04	46.39	12.95	40.05	10.95
Condition 2	53.48	14.87	45.87	12.67	52.70	17.58	45.37	14.76	52.09	17.98	45.47	16.28	52.19	19.58	44.52	16.70
Condition 3	39.23	16.90	33.56	12.64	46.12	14.87	45.37	12.51	46.68	16.72	37.44	13.03	45.26	15.73	36.59	12.92
Condition 4	37.22	18.44	33.07	33.07	32.30	20.17	30.09	16.82	29.18	20.93	28.92	14.92	28.46	20.66	26.28	15.30

Note: Condition 1: Ratings of Non Anxious Boy, Condition 2: Ratings of Non Anxious Girl, Condition 3: Ratings of Anxious Boy, Condition 4: Ratings of Anxious Girl

Table 2. ANCOVA – Respondents' Anxiety and their Likeability and Self-Disclosure ratings

		T1: Photo				T2: General Info				T3: Positive self-disclosure				T4: Negative self-disclosure			
		Like		Desire		Like		Desire		Like		Desire		Like		Desire	
		MD		*MD*		*MD*		*MD*		*MD*		*MD*		*MD*		*MD*	
Condition 1	**Condition 2**	- 9.97	< .001	-9.33	< .001	- 8.52	> .001	-7.37	= .001	- 6.81	> .001	- 7.69	< .001	- 5.98	> .001	- 4.61	> .001
	Condition 3	4.38	>.001	3.06	>.001	- 1.84	>.001	.15	>.001	- 1.28	>.001	.40	>.001	1.14	>.001	3.47	>.001
	Condition 4	6.38	>.001	3.55	>.001	11.97	<.001	8.01	<.001	16.21	< .001	8.91	< .001	17.92	< .001	13.77	< .001
Condition 2	**Condition 3**	14.36	< .001	12.40	< .001	6.68	> .001	7.52	<.001	5.53	> .001	8.09	<.001	7.07	> .001	8.07	<.001
	Condition 4	16.35	< .001	12.89	< .001	20.49	<.001	15.38	<.001	23.02	<.001	16.60	<.001	23.86	<.001	18.37	<.001
Condition 3	**Condition 4**	1.94	>.001	.48	>.001	13.81	<.001	7.85	<.001	17.49	<.001	8.51	<.001	16.78	<.001	10.30	<.001

Note. Condition 1 refferes to Ratings of Non Anxious Boy, Condition 2: Ratings of Non Anxious Girl, Condition 3: Ratings of Anxious Boy, Condition 4: Ratings of Anxious Girl

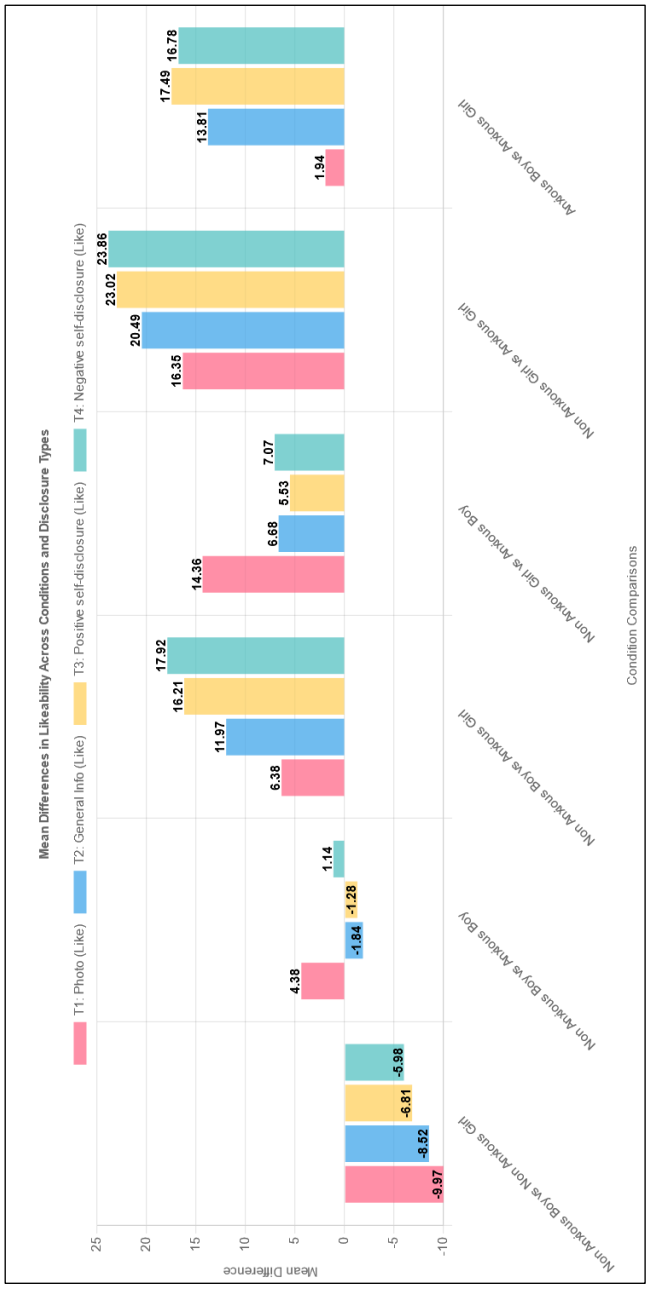


Figure 3. A visual description of respondents' Anxiety and their Likeability and Self-Disclosure ratings

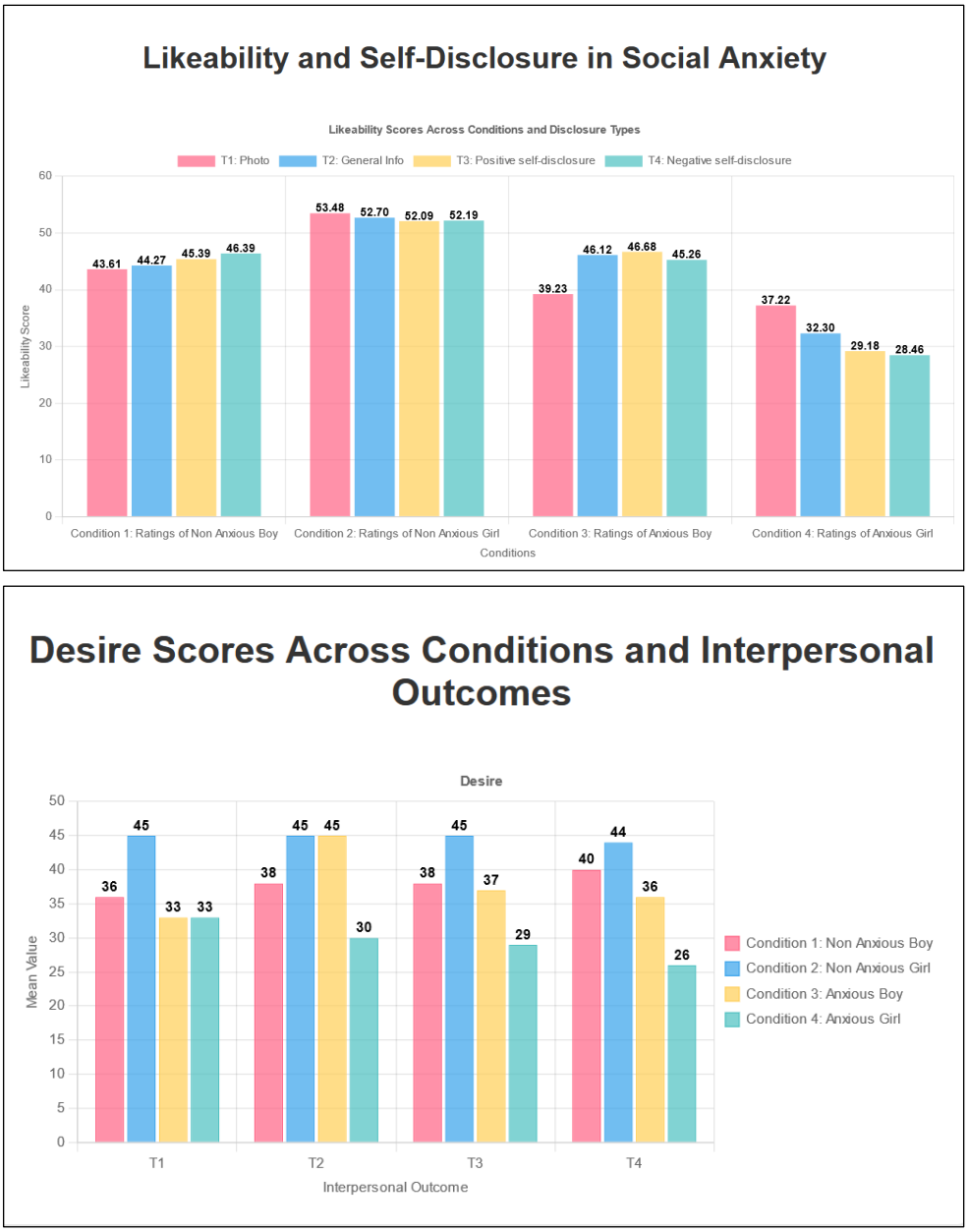


Figure 4. A visual description of mean differences in likeability and desire

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NATURALISTIC SHORT-TERM ASSOCIATIONS BETWEEN AUTOMATIC THOUGHTS, IRRATIONAL BELIEFS, AND DEPRESSIVE SYMPTOM SEVERITY DURING INITIAL SSRI TREATMENT IN MAJOR DEPRESSIVE DISORDER

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Abstract

Cognitive models of depression distinguish between proximal automatic thoughts and broader irrational belief systems. However, little is known about how these cognitive contents co-vary with depressive symptoms during the early phase of pharmacological treatment under naturalistic conditions. This study examined short-term associations between automatic thoughts (ATs), irrational beliefs (IBs), and depressive symptom severity during the first four weeks of selective serotonin reuptake inhibitor (SSRI) initiation. Forty-four outpatients meeting DSM-5 criteria for major depressive disorder were assessed at baseline and after four weeks of SSRI treatment. Measures included the Beck Depression Inventory (BDI), Automatic Thoughts Questionnaire (ATQ), and Irrational Beliefs Scale (ABS-2). Hierarchical regression analyses examined cross-sectional and change-score associations. Effect sizes (f^2) and 95% confidence intervals were reported. Automatic thoughts demonstrated strong cross-sectional associations with depressive severity at baseline ($R^2 = .598$, $f^2 = 1.49$) and week four ($R^2 = .774$, $f^2 = 3.42$). Irrational beliefs showed moderate associations ($R^2 = .37$, $f^2 = .59$). In hierarchical models, ATQ scores accounted for substantial incremental variance beyond irrational beliefs (ΔR^2 range: .21–.34). Change-score analyses indicated strong concurrent covariation between reductions in automatic thoughts and symptom improvement. Findings suggest that proximal cognitive content (automatic thoughts) closely tracks depressive symptom

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severity during SSRI treatment under naturalistic conditions. Results should not be interpreted as causal or predictive but rather as descriptive of concurrent cognitive–symptom dynamics. Controlled longitudinal designs are required to evaluate temporal precedence.

Keywords: depression, automatic thoughts, irrational beliefs, SSRI, naturalistic study, cognitive content

Cognitive theories of depression indicate that maladaptive cognitive content plays a central role in the manifestation and maintenance of depressive symptoms. Within hierarchical cognitive frameworks, a distinction is made between proximal automatic thoughts (ATs) and broader, more enduring belief structures (Beck & Haigh, 2014). Major depressive disorder (MDD) is marked not only by affective and behavioral symptoms but also by systematic distortions in cognitive context. CBT proposes that an individual's emotions and behaviors are outcomes of cognitive processing that can be influenced by distinct interventions that change these outcomes at different levels of cognition (David & Szentagotai, 2006). A belief is a three-layered cognitive structure. The inner layer, core beliefs, comprises underlying views about oneself, others, and the world; intermediate beliefs operate in an individual's view of the event, affecting thoughts, emotions, and behaviors. The third layer, ATs, is affected by core and intermediary beliefs (Clark & Beck, 1999). ATs are considered state-dependent and directly activated during depressive episodes. Many studies have revealed significant relationships between ATs and symptoms of depression (Buschmann et al., 2018; Choon et al., 2015; Yığman et al., 2022; Kazdin, 1990).

Cognitive theory distinguishes between ATs and broader, trait-like irrational beliefs (IBs) (Beck & Haigh, 2014; David et al., 2009). ATs are situation-specific cognitive products reflecting activated schemas, whereas irrational beliefs are conceptualized as relatively stable cognitive vulnerabilities. A is an activating event, B represents irrational beliefs (IBs) or rational beliefs (RBs), and C represents the emotional or behavioral results in the ABC model of Ellis. RBs can be distinguished by IBs with functional and healthy outcomes, which are flexible, logical, and goal-oriented. However, IBs are nonpragmatic, rigid, and incongruent with reality, and they cause psychopathologies (DiLorenzo et al., 2007). Researchers have reported a significant relationship between IBs and depressive symptoms (Duru & Balkıs, 2022; Oltean et al., 2017; Vîslă et al., 2016). In addition, the RBs play a protective role in the onset of psychopathology (Hyland et al., 2014) and depression (Balkıs & Duru, 2019).

Many studies have assessed the relationships between IBs and ATs. Szentagotai and Freeman (2007) postulated that the direct effect of IBs on depression sustained after the mediator variable ATs is added into the model, which could

demonstrate that IBs directly influence negative emotions, not those caused by ATs. Buschmann et al. (2018) noted that ATs partially mediated the effect of IBs on depressive affect, but IBs still had a direct significant effect on depression, and ATs fully mediated the effects of IBs on depression.

Recent cognitive theories of depression propose that maladaptive cognitions, such as negative ATs and IBs, are modifiable through therapeutic interventions, including pharmacological treatment (Beck & Alford, 2009; Dryden & Bond, 1994). Several studies have reported that selective serotonin reuptake inhibitors (SSRIs) are associated with reductions in negative biases and dysfunctional thought systems (DeRubeis et al., 2008; Harmer et al., 2009). Harmer et al. (2009) indicated that antidepressants can change emotional and cognitive processing early in treatment, even before symptomatic improvement becomes evident, proposing that cognitive change may be a mechanism of antidepressant response. Moreover, cognitive change has been found to partially mediate the relationship between pharmacotherapy and depressive symptom reduction (Garratt et al., 2007). Quigley et al. (2019) conducted a longitudinal mediation analysis to compare the effects of CBT and antidepressant treatment on dysfunctional beliefs and automatic thoughts over a 16-week period. Their findings demonstrated that both treatment modalities led to significant reductions in depressive symptoms and maladaptive cognitions. However, while concurrent associations were observed between cognitive content and depression severity, cross-lagged effects indicating that cognitive changes prospectively predicted symptom improvement were not supported. These results suggest that although antidepressant treatment may influence cognitive processes alongside symptom reduction, the role of cognitive change as a mediating mechanism—especially in pharmacological interventions—remains inconclusive (Quigley et al., 2019). Szentagotai et al. (2008) reported that pharmacotherapy, which included fluoxetine before and after treatment and a treatment duration of 14 weeks, differed in terms of ATs, dysfunctional attitudes (intermediate and core beliefs), and IBs. The correlation analysis conducted in the same study revealed that the change in depression scores between pretreatment and posttreatment was associated with ATs, dysfunctional attitudes, and irrational beliefs with articulated thoughts in simulated situations (IB-ATSS) (Szentagotai et al., 2008). Studies have shown that negative ATs, which include fluoxetine and amitriptyline, are significantly reduced in depressed patients after 16 weeks of antidepressant therapy (Rana et al., 2017). In addition, ATs were significantly reduced between pre- and posttreatment at 16 weeks after treatment with 25–50 mg/gün daily sertraline (Iftene et al., 2015).

Although cognitive variables have been extensively studied in psychotherapy research, considerably less attention has been given to how these constructs co-vary with depressive symptom severity during pharmacological treatment, particularly under naturalistic outpatient conditions. Most antidepressant research emphasizes symptom reduction, while concurrent cognitive dynamics

during early treatment phases remain comparatively underexplored. While cognitive-behavioral models have extensively examined cognitive change during psychotherapy, less is known about how cognitive content covaries with depressive symptoms during pharmacological treatment. Importantly, pharmacotherapy may influence affective reactivity and cognitive processing, but naturalistic outpatient designs rarely allow conclusions about mechanisms or treatment efficacy. The present study aimed to examine short-term associations between depressive severity, ATs, and IBs during the first four weeks of SSRI treatment in a naturalistic clinical sample. Rather than testing causal mechanisms of antidepressant action, this study sought to evaluate concurrent relationships and relative predictive contributions within the same statistical models.

We hypothesized that:

1. ATs would demonstrate strong cross-sectional associations with depressive severity.
2. IBs would show weaker unique contributions when evaluated simultaneously with ATs.
3. Changes in automatic thoughts would significantly predict changes in depressive symptom severity after controlling for baseline depression.

Method

Participants and procedure

The study was conducted as a 4-week follow-up, and the sample consisted of 44 volunteer participants who were diagnosed with depression via the Structured Clinical Interview for Diagnostic and Statistical Mental Disorders 5-Clinician Version (SCID 5-CV) evaluation (Elbir et al., 2019) and were started on a SSRI by a psychiatrist The researchers involved in the study were trained as CBT experts before data collection. The training encompassed the standardized interview protocol, delivery of psychoeducation, and conduct of the study procedures. Our study sample comprised individuals aged 18–65 years who were admitted to the psychiatry outpatient unit of a hospital for 2 months in 2023–2024, after ethical approval was obtained. The exclusion criteria for the study were having schizophrenia and psychotic disorders, bipolar disorders, neurological disorders, intellectual disability, and substance use disorders according to the DSM-5 (American Psychiatric Association, 2013), and receiving psychotherapy or treatment with antidepressant and antipsychotic drugs. Six of the 50 patients were excluded from the study. This exclusion was based on having had antidepressant treatment by four participants, and two participants did not want to continue for one month following the study. Therefore, our study included 44 patients in the final evaluation. Individuals with a diagnosis of depression were included in the study, and they

completed test batteries. Patients diagnosed with depression were assigned to receive SSRI antidepressant treatment and were invited to meet once a week. While the first interviews lasted 50 minutes, the subsequent interviews lasted 40 minutes. Treatment focused on pharmacotherapy of patients, including educating patients about medical treatment, adjusting doses, and addressing drug-related side effects. Clinical management included evaluating the patient's functional status and providing limited guidance. The treatment protocol was a beginning dose that started with half the lowest effective dose of the antidepressant for depression and increased to the lowest effective dose in the first week. Participants were provided with detailed information about our research and gave informed consent. Ethical approval for the study was received from the Yuksek Ihtisas University Ethics Committee on 31.03.2023, with decision number 2023/02/06, and the study was conducted in accordance with the ethical standards of the 2013 Helsinki Declaration.

Data collection tools

Beck Depression Inventory (BDI; Beck, 1961): A 21-item scale used to evaluate depressive symptoms. This scale is self-reported and scored from 0 to 3 (Beck et al., 1961). Hisli (1988) assessed Turkish adaptation, and its psychometric properties were comparable with those of the original questionnaire. Cronbach's alphas for the BDI ranged from .79 to .94 in the clinical samples. The Cronbach's alpha values of the BDI, split-half, and test-retest methods were calculated as .80, .74, and .78, respectively (Hisli, 1988). In this research, Cronbach's alphas for this scale were .80 and .93 for pretreatment and posttreatment depressive patients, respectively.

Automatic Thoughts Questionnaire (ATQ; Hollon & Kendall, 1980): The ATQ has 30 items that assess the frequency of negative automatic thoughts related to depression. This measurement is scored on a 1–5 scale, self-reported, and has a five-factor structure (Hollon & Kendall, 1980). The Turkish adaptation of the ATQ has been used in several studies and has psychometric properties similar to those of the original questionnaire (Aydın & Aydın, 1990; Şahin & Şahin, 1992). The Cronbach's alpha value and split-half reliability of the adapted ATQ were calculated as .93 and .91, respectively. The Cronbach's alpha values for this scale were .96 and .98 for the pretreatment and posttreatment groups, respectively.

The Attitudes and Belief Scale-2 (ABS-2; DiGiuseppe et al., 2018) consists of 72 items that measure irrational beliefs, with uncontaminated affective items. This measurement is scored on a 0–4 scale and self-reported. The ABS-2 evaluates REBT's IBs and RBs and uses a four-factor solution. The ABS-2 showed satisfactory internal consistency, good reliability, and high construct validity (DiGiuseppe et al., 2018). Turkish adapted version was created by Artiran and DiGiuseppe (2020) with 76 items. The first four items, which were not evaluated on the original scale, are analyzed according to preference and are not mandatory. The adapted version has similar psychometric properties to the original questionnaire (Artiran & DiGiuseppe,

2020). The Cronbach's alpha values were .94 and .85 for ABS-2 rational beliefs for pretreatment and posttreatment, respectively, in depressive patients in this research. The ABS-2 IBs' Cronbach's alpha values were .92 and .96 for pretreatment and posttreatment, respectively, in depressive patients in this research.

Statistical analysis

We performed analyses via IBM SPSS (version 25.0). Descriptive statistics were analyzed, and, for comparisons, a dependent-samples t-test was used to determine differences between pretreatment and posttreatment measurements. Pearson correlation analysis was used to examine the relationships between variables. A value of $p < .05$ was considered to imply statistical significance. Skewness and kurtosis were analyzed to assess the normality of the predicted variable, confirming normality. With all assumptions met, multiple regression analyses were conducted separately for baseline and week four. Change analyses included baseline depression scores and difference scores (ΔAT, ΔIB). Variance inflation factors (VIFs) were used to assess multicollinearity. Residual independence was assessed using the Durbin–Watson statistic, and effect sizes were calculated.

Results

Clinical characteristics

The study included 44 individuals with depression, 63.6% (n = 28) of whom were female and aged 20–52 years (mean age = 29.75 ± 7.08 years). The patients recruited for the study had a mean number of years of education of 16.14 ± 1.11. In Table 1, the parenthetical numbers for age and education represent standard deviations which is next to mean, not percentages. For marital status, 45.5% of the patients (n = 20) were single/dating, 4.5% (n = 2) were cohabitating, and 50% (n = 22) were married. With respect to occupation, 6.8% of the patients (n = 3) were unemployed, 9.1% (n = 4) were housewives, 81.8% (n = 36) were civil servants/workers, and 2.3% (n = 1) were retired. The number of previous episodes of depression ranged from 0–6 (mean = 2.31 ± 1.46) (Table 1).

Table 1. Sociodemographic characteristics of clinical depression sample

		Depression sample (N = 44)
Age; year *M (SD)*		29.75 (7.08)
Years of education; year *M (SD)*		16.14 (1.11)
Sex	Female	28 (63.6%)
	Male	16 (36.4%)
Marital status	Single	20 (45.5%)
	Married	22 (50%)
	Other	2 (4.5%)
Occupation	Unemployed	3 (6.8%)

		Depression sample (N = 44)
	Housewives	4 (9.1%)
	Civil servants/workers	36 (81.8%)
	Retired	1 (2.3%)
Past treatment	Yes	16 (36.4%)
	No	28 (63.6%)

Two measurements were performed to evaluate the relationships between baseline and after four weeks of SSRI treatment, and changes in ATs and rational and irrational belief scores in depression patients (baseline and after four weeks of SSRI treatment). Table 2 presents the results of the dependent-samples t-test. The baseline and after four weeks of SSRI treatment results of the depression and AT levels of the patients were significantly different. The baseline levels were significantly greater than those after four weeks of SSRI treatment. The effect size of the significant difference in practice was calculated and found to be large in general. The baseline and after four weeks of SSRI treatment results of the levels of the subdimensions of the ABS-2 were significantly different. The baseline levels are higher than those after week four, and this difference is significant. The effect size of the significant difference in practice was calculated, and it was determined to generally have a medium effect on IBs and a small effect on RBs (Cohen, 2013).

Table 2. Results of dependent samples t-test for comparison of patients' baseline and after week four measurements (N = 44)

Variables		Mean	*SD*	t	*p*	df	d	Mean diff.	95% CI (Mean Diff.)
BDI	Baseline	24.80	8.43	5.369	.000	43	.809	9.75	[6.09, 13.41]
	After four weeks	15.05	12.09						
ATQ	Baseline	89.02	26.24	5.911	.000	43	.891	21.93	[14.45, 29.41]
	After four weeks	67.09	30.02						
ABS-2- rational beliefs	Baseline	74.20	24.69	2.178	.035	43	.328	7.79	[0.58, 15.00]
	After four weeks	66.41	23.37						
ABS-2- irrational beliefs	Baseline	82.82	27.86	4.097	.000	43	.618	12.18	[6.19, 18.17]
	After four weeks	70.64	27.45						

Note: BDI = Beck Depression Inventory; ATQ = Automatic Thoughts Questionnaire; ABS-2 = Attitudes and Belief Scale-2. *p < .05

Table 3 presents the associations between ATs and IBs at baseline and after a 4-week treatment phase, examined using Pearson's correlation coefficients. The findings indicate a strong and statistically significant positive correlation between ATs and IBs prior to treatment (r = .69, 95% CI [.49, .82], p < .001). A comparably robust and significant positive association was also observed following treatment (r = .67, 95% CI [.46, .80], p < .001). These results show that ATs and IBs stay

strongly associated with both baseline and after four weeks of pharmacological intervention.

Table 3. Correlations between variables

Measurement time	Variables	r	95% CI for r	p
Baseline (T1)	Automatic Thoughts – Irrational Beliefs	.688	[.49, .82]	< .001
After four week (T2)	Automatic Thoughts – Irrational Beliefs	.665	[.46, .80]	< .001

Table 4 shows the relative contributions of ATs and IBs to predicting depression severity within the same multiple regression analysis, separately for the baseline and the first 4 weeks of SSRI treatment. The ATs and IBs jointly accounted for approximately 63% of the variance in depression scores ($R^2 = .63$, $F(2, 41) = 34.24$, $p < .001$). ATs emerged as a strong and statistically significant predictor of depression severity ($\beta = .65$, $p < .001$), whereas IBs did not provide a significant incremental contribution after controlling for ATs ($\beta = .18$, $p = .171$). The first four weeks of SSRI treatment were likewise statistically significant ($R^2 = .78$, $F(2, 41) = 72.36$, $p < .001$), explaining approximately 78% of the variance in depression levels. ATs stayed a very strong predictor of depressive symptom severity ($\beta = .90$, $p < .001$). The IBs were not significantly related to depression severity in the presence of ATs ($\beta = -.03$, $p = .800$).

For both models, there is no evidence of problematic multicollinearity (VIF < 2), and regression assumptions were achieved at acceptable levels. Residual independence was tested with the Durbin–Watson statistic, which generated values of 2.25 for the baseline model and 2.27 for the first four weeks of the SSRI treatment model. Given that both values are approximately 2, there is no evidence of substantial positive or negative autocorrelation among the residuals, supporting the assumption of independence.

Table 4. The Relative Contributions of Automatic Thoughts (AT) and Irrational Beliefs (IB) to Predicting Depression Severity: Pre-test and Post-test Multiple Regression Models

Models	Predictors	B	SE	β	t	p	%95 Cl (B)	VIF
BDI (T1)	Automatic Thoughts	0.210	0.042	0.653	4.96	< .001	[0.124, 0.295]	1.90
	Irrational Beliefs	0.056	0.040	0.184	1.39	.171	[−0.025, 0.136]	1.90
		$R = .79$, $R^2 = .63$, Adj. $R^2 = .61$						
	Model statistics	$F(2,41) = 34.24$, $p < .001$,						
		Durbin-Watson = 2.25						
BDI (T2)	Automatic Thoughts	0.362	0.040	0.899	9.15	< .001	[0.282, 0.442]	1.80
	Irrational Beliefs	−0.011	0.043	−0.025	−0.26	.800	[−0.098, 0.076]	1.80
		$R = .88$, $R^2 = .78$, Adj. $R^2 = .77$						
	Model statistics	$F(2,41) = 72.36$, $p < .001$						
		Durbin-Watson = 2.27						

Table 5 presents the prediction of depression severity by changes in ATs and IBs, while controlling for baseline depression levels. The multiple regression model was statistically significant ($R^2 = .73$, $F(3, 40) = 36.23$, $p < .001$), accounting for approximately 73% of the variance in depressive symptom severity after 4 weeks. The baseline depression severity appeared as a significant predictor of depression scores after four weeks of SSRI treatment depression scores ($\beta = .60$, $p < .001$), clarifying expected temporal stability in symptom levels. The change in ATs (ΔAT) remained a strong and statistically significant predictor of post-treatment depression severity, even after controlling for initial depression levels ($\beta = .73$, $p < .001$). The change in IBs (ΔIB) did not contribute significantly to predicting depressive symptom change when baseline depression and changes in ATs were simultaneously modeled ($\beta = .12$, $p = .283$). There is no evidence of substantial positive or negative autocorrelation among the residuals, supporting the assumption of independence; the Durbin–Watson statistic was 2.36.

Table 5. Predicting Changes in Depression Severity: Relative Contributions of Baseline and Changes in Automatic Thoughts and Irrational Beliefs

Predictors	B	SE	β	t	p	%95 Cl (B)	VIF
BDI (T1)	0.861	0.124	0.601	6.94	< .001	[0.610, 1.112]	1.12
Automatic Thoughts (ΔAT)	0.358	0.057	0.728	6.23	< .001	[0.242, 0.474]	2.03
Irrational Beliefs (ΔIB)	0.075	0.069	0.122	1.09	.283	[−0.064, 0.214]	1.88
	$R = .86$, $R^2 = .73$, Adj. $R^2 = .71$						
Model statistics	$F(3,40) = 36.23$, $p < .001$						
	Durbin–Watson = 2.36						

Discussion

Our study examined naturalistic short-term relationships between depressive symptom severity and cognitive structures, which are ATs and IBs, during the onset and after four weeks of SSRI treatment in patients with MDD. Three principal findings were established. Firstly, ATs illustrated vigorous cross-sectional associations with depression levels both at onset and after SSRI treatment. Alongside IBs, ATs maintained strong independent correlations, whereas IBs did not contribute unique variance. This pattern was indicated consistently at baseline and week four. Second, the extent of explained variance was substantial ($R^2 = .63–.78$), corresponding to very large effect sizes ($f^2 = 1.70–3.55$). Third, change in ATs remained strongly associated with change in depressive level even after controlling for baseline depression. Changes in IBs did not provide additional explanation when ATs were involved in the same model. This could be related to their relationship with depression, which may operate indirectly through proximal cognitive content or shared variance. This pattern suggests that ATs account for depressive symptom variance more directly, whereas IBs may exert their effect indirectly by activating

ATs. This result is consistent with schema-driven activation models in which deeper belief structures necessitate proximal cognitive mediators to affect mood states (Clark & Beck, 2010). The ATs from these cognitions are associated with depression (Buschmann et al., 2018; Choon et al., 2015; Kazdin, 1990), directly predict the severity of depressive symptoms (Balkıs & Duru, 2019; Yığman et al., 2022), and play a mediating role in adverse life events (Beck & Haigh, 2014). The IBs function as cognitive vulnerability reservoirs, whereas ATs operate as the mechanism of emotional translation.

Ellis's rational emotive therapy indicated that IBs have the pathogenic cognitions underlying emotional psychopathologies (Ellis, 1962, 1994). But the IBs showed zero-order associations with depression and its change; their predictive contribution was attenuated once changes in ATs were entered into the model. This attenuation is consistent with a mediated pathway involving the activation of automatic cognitions, in which IBs function as distal vulnerability structures. The shared variance between IB change and depressive improvement appears largely absorbed by changes in ATs, supporting a proximal mediation architecture rather than a parallel, independent-effects model (DeRubeis et al., 1990; Garratt et al., 2007). However, the literature does not support a fully mediated pathway. Szentagotai and Freeman (2007) demonstrated that the direct impact of IBs on depression persisted even after ATs as mediators. Buschmann et al. (2018) showed that when stress was statistically controlled, ATs fully mediated the relationship between IBs and depressive symptoms. One possible explanation for inconsistencies across studies concerns measurement overlap. As noted by Szentagotai and Freeman (2007), conventional self-report measures of ATs and IBs often share conceptual and semantic content, potentially inflating shared variance and complicating distinctions between proximal and distal cognition, such as the Irrational Beliefs–Articulated Thoughts in Simulated Situations (IB-ATSS) (Davison et al., 1983; Szentagotai & Freeman, 2007). Szentagotai and Freeman (2007) reported that IB-ATSS scores were not significantly changed by pharmacotherapy from pretreatment to posttreatment, suggesting that pharmacological interventions may differentially influence proximal cognitive content relative to deeper, structurally embedded IBs.

Several limitations merit emphasis. Conclusions must be interpreted within the constraints of a naturalistic design. Participants received routine antidepressant treatment without experimental manipulation of cognitive variables; the sample size was modest, treatment was not standardized, and all measures were derived from contemporaneously administered self-report instruments. Furthermore, the high proportion of female participants, heterogeneity in the number of past depression episodes, is essential for understanding ATs (Batmaz et al., 2015) and IBs (Solomon et al., 1998) and variability in episode history introduces heterogeneity that may influence generalizability. Thus, although the statistical pattern is compatible with a cognitive mediation hypothesis, temporal precedence and causal sequencing cannot be definitively established. Nonetheless, the fact that proximal cognitive change accounted for substantial variance in depressive improvement—even after controlling

for baseline severity—strengthens the plausibility of automatic thoughts as key mechanisms of change rather than mere epiphenomena of mood improvement.

Conclusion

The ATs and IBs may represent ecologically valid cognitive dynamics in depressive psychopathology. While the statistical pattern is compatible with a Beckian proximal-cognitive dominance model, causal pathways remain inferential rather than empirically established. The findings do not invalidate the REBT framework; rather, they suggest that IBs may function as distal vulnerability structures whose clinical impact becomes manifest primarily through the generation of ATs. Future research employing longitudinal mediation models, cross-lagged panel designs, or structural equation modeling would be required to formally test whether changes in ATs fully or partially mediate the relationship between changes in IBs and depressive symptom trajectories. Such designs would allow for stronger inferences regarding directional cognitive mechanisms and the temporal unfolding of vulnerability activation.

Declarations

Ethical considerations: Ethical approval was received for the study from the Yuksek Ihtisas University Ethics Committee, dated 31.03.2023, with decision number 2023/02/06, which was conducted per the ethical standards in the 2013 Helsinki Declaration.

Consent of Patients: The participants were informed in detail, and informed consent was obtained.

Consent for publication: Not applicable.

Data availability statement: All relevant data are within the paper and are available from the corresponding author upon reasonable request.

Declaration of interest statement: On behalf of all the authors, the corresponding author states that there are no conflicts of interest.

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INTEGRATION OF COGNITIVE BEHAVIORAL AND SCHEMA THERAPY IN GENDER BIASES CORRECTION

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Abstract

This article presents a theoretical model of a training program that integrates cognitive behavioral therapy (CBT) and schema therapy to address and correct gender biases. The goal is to propose an evidence-informed framework for reducing both implicit and explicit gender bias through psychological intervention. Drawing on existing research, we designed a twelve-session program structured into four modules: cognitive awareness, schema identification, cognitive restructuring, and reinforcement. Each session combines psychoeducation, individual reflection, and behavioral experimentation. The proposed model is grounded in a dual-level approach that simultaneously targets surface-level cognitive distortions and deeper maladaptive schemas. It is designed to be adaptable for use in educational, clinical, and organizational contexts. This integrative program provides a theoretically grounded intervention with the potential to reduce gender bias in diverse settings. While empirical testing is still required, the model offers a promising foundation for future applied research.

Keywords: gender stereotypes, implicit bias, integrative therapy, schema restructuring, psychoeducational training, cognitive reframing.

Despite notable advancements toward gender equality, gender bias remains a persistent and significant issue across societies. These biases negatively affect individuals of all genders by fostering distress and internal conflict when societal expectations are misaligned with personal identity. As highlighted in the *Global*

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Gender Gap Report 2023 (World Economic Forum, 2023), at the current pace, it may take more than 130 years to achieve full gender parity worldwide.

Yet, the academic study of gender bias continues to be underrepresented. Bibliometric analyses have shown that research on gender bias often receives less funding and is published in journals with lower impact factors compared to studies on other forms of social discrimination (Cislak et al., 2018). This trend is consistent across disciplines, from higher education (Peterson et al., 2019) to technological innovation (Carvalho et al., 2020).

From a humanistic perspective, gender biases represent not only social and psychological challenges but also fundamental violations of human dignity and self-expression. These socially constructed constraints limit individuals' capacity to fulfill their potential by forcing them into restrictive gender roles that undermine the complexity of human experience. The humanistic tradition, with its emphasis on personal growth, self-actualization, and social justice, offers a compelling framework for understanding and addressing these systemic forms of oppression that inhibit human flourishing.

At the same time, the issue of gender bias remains critically important in research, as highlighted by various academic publications. There are studies examining the effects of ageism and contemporary beauty standards on women's mental health. They specifically address gender ageism targeting women over 40 and its detrimental effects on their mental well-being, emphasizing the need to combat age discrimination (Danylova et al., 2024).

Theoretical background

To gain a deeper understanding of the nature and mechanisms of gender bias, it's essential to start with a clear definition and classification of the concept. Gender bias, as defined by the American Psychological Association (APA), refers to a range of stereotypical beliefs about individuals based on their gender ((APA, n.d.). There are three primary forms of gender bias: descriptive stereotypes, behavioral discrimination, and internalized biases (Dinan et al., 2020). These biases can even be observed in modern technologies. For instance, a study conducted by Lozoya et al. (2023) revealed that artificial intelligence often reproduces traditional gender stereotypes, associating men with traits linked to competence (such as monetary success, work, and cognitive ability) and women with qualities related to warmth (such as home life, feelings, and emotions).

Numerous studies on gender bias have highlighted a clear dichotomy between attributes traditionally associated with male and female characteristics (Broverman et al., 1972; Diekman & Eagly, 2000). Leadership qualities and task performance are often stereotypically attributed to men, while women are frequently

associated with traits related to the family sphere. Although these family-related characteristics hold social value, they can negatively affect women's sense of self-worth and limit their opportunities for personal growth. This bias is particularly evident in educational settings. The research has demonstrated that even when girls perform better academically, their abilities and talents are often underestimated, expectations for them are lowered, and their behavior is confined to stereotypical feminine roles (Berekashvili, 2012).

Empirical evidence indicates that gender biases persist even in developed societies, reinforcing internalized self-limiting beliefs that affect individuals' confidence, self-perception, and psychological well-being (Gaucher et al., 2011; Koch et al., 2015).

Moreover, the internalization of gender stereotypes has a detrimental impact on the psychological well-being of both women and men. It contributes to increased anxiety, depressive manifestations and complications in professional self-actualization. This issue is particularly evident in the realm of innovation and patenting. A study by Carvalho et al. (2020) reveals that even in developed countries, women's involvement in patent applications does not exceed 30%.

Gender biases arise from the intricate interplay between individual cognitive processes and sociocultural influences. One noteworthy aspect of these biases is their persistence, even when individuals recognize their harmful effects. This reality often calls for targeted therapeutic interventions. However, a meta-analysis (Fernández-Fernández et al., 2021) indicates that the effectiveness of current intervention programs aimed at overcoming gender bias remains ambiguous and requires further research.

The theoretical foundation for understanding gender biases is best explained by Gender Schema Theory, which suggests that gender typing arises from the way individuals process information based on associations related to gender (Bem, 1981). An analysis conducted 34 years after the theory was introduced (Starr & Zurbriggen, 2017) demonstrates its continued relevance, not only within psychology but also in fields such as international relations, communication, and business research, particularly in the exploration of discrimination, stereotypes, professional fulfillment, and mental health.

A meta-analysis of childhood memory studies (Signorella et al., 1997) confirmed that gender biases begin to form in the early stages of development, affecting the selectivity of an individual's memory regarding gender-related information. These early cognitive schemas later influence the perception and interpretation of social information. Furthermore, gender schemas and the socio-cognitive processes of parents directly impact parenting styles, creating mechanisms for the transmission and consolidation of gender roles within the family context (Tiwari, 2024).

Purpose of the study

The aim of this study is to develop and substantiate an integrative approach for correcting gender biases by combining the methodologies of cognitive behavioral therapy (CBT) and schema therapy (ST). Although both of these therapeutic approaches have proven to be highly effective in addressing dysfunctional beliefs and deep-rooted personality schemas (Hofmann et al., 2012; Peeters et al., 2021), their potential effectiveness in addressing gender bias has not been sufficiently researched.

This integrative approach is grounded in humanistic values that recognize each individual's inherent worth and potential for growth beyond socially imposed limitations. By combining feminist perspectives with evidence-based therapeutic interventions, we aim to create a liberating framework that empowers individuals to transcend restrictive gender schemas and develop more authentic, self-determined ways of being in the world.

Numerous studies highlight the importance of addressing not only superficial beliefs but also deep-rooted personality schemas (Martin et al., 2002; Toner, 1994). The proposed approach aims to provide a comprehensive framework that incorporates modern research in psychotherapeutic integration (Al-Roubaiy, 2020) along with a feminist perspective (Vatcher & Bogo, 2001). Special emphasis will be placed on integrating feminist perspectives and emotionally focused techniques into the overall structure of cognitive-behavioral interventions. This integration is intended to create a more effective and comprehensive model for correcting gender biases.

Methodology

The methodological foundation of this study integrates theoretical principles and practical methods from cognitive-behavioral therapy (CBT) and schema therapy (ST). It utilizes the theoretical aspects of CBT, particularly focusing on cognitive biases and their modification, as well as cognitive restructuring techniques. The methodological principles of schema therapy are also taken into account covering early maladaptive schemata and an integrative approach to work with deep-seated beliefs.

Additionally, the study draws on modern techniques for mitigating cognitive biases, emphasizing the similarities between gender groups, interactive teaching methods, and the practical development of new behavior patterns. A systematic approach is employed, allowing for the consideration of gender biases as a complex

phenomenon that necessitates multi-level correction, ranging from superficial cognitive distortions to deep personality schemata.

Cognitive-behavioral therapy (CBT) is recognized as one of the most effective methods for correcting dysfunctional cognitions. It facilitates the modification of maladaptive thinking patterns and contributes to the formation of rational attitudes, increasing an individual's resilience to stress, and improvement of emotional well-being and interpersonal relationships (Hofmann et al., 2012). CBT encompasses a diverse array of techniques and methodologies, all of which have been rigorously validated by numerous scientific studies.

One of the key areas of CBT is the modification of cognitive biases (MCB). This refers to a set of psychological methods designed to correct distortions in thinking that influence how information is perceived and interpreted (Beard, 2011). Research has demonstrated a direct correlation between cognitive biases and the development of various anxiety and depressive disorders, including depression, social anxiety disorder, and generalized social phobia (Foa et al., 1996; Hallion & Ruscio, 2011; Li et al., 2023).

A crucial component of the MCB is the modification of cognitive biases in interpretations, which aims to transform how individuals perceive ambiguous situations (Beard & Amir, 2008). Special exercises, such as resolving ambiguous stories, are implemented to help participants develop a tendency for more positive interpretations (Blackwell & Holmes, 2010). Complementing this approach, the learning of approximation and avoidance techniques is employed to alter emotional reactions to specific stimuli by creating new associations between those stimuli and behavioral reactions (Rinck & Becker, 2007).

Mitigating cognitive biases is a crucial part of working with dysfunctional cognitions. One of the most common methods of mitigating biases is training programs designed to change participants' attitudes and eliminate stereotypes that contribute to biased behaviors (Caleo & Heilman, 2019). However, some studies have found that the enhancements in attitudes and behaviors resulting from diversity training may lack long-term effectiveness, as they often diminish over time (Bezrukova et al., 2016).

An innovative approach within Cognitive Behavioral Therapy (CBT) involves the use of video games, exemplified by the game "Missing." A study has demonstrated a statistically significant increase in awareness of biases and an improvement in the ability to overcome them, with students experiencing a 25% increase and experienced analysts seeing a 27% increase (Symborski et al., 2014). However, an analysis of 11 studies examining the effects of gaming and video interventions on bias mitigation revealed mixed results regarding long-term effects (Korteling et al., 2021).

A key element of CBT is cognitive restructuring, which focuses on identifying, evaluating, and changing maladaptive thoughts. Within this approach, Socratic questions and the "downward arrow" technique are actively

used, which allows for uncovering deep-seated beliefs (Wenzel, 2017). An important tool in this process is the recording of thoughts, a systematic method of tracking automatic thoughts, emotions, and behavior. Cognitive cards are utilized to consolidate new, more rational thoughts, while behavioral experiments are conducted to test the compliance of negative predictions with reality.

When developing adaptive alternatives, it is essential to ensure that new ideas are realistic, specific, and grounded in available evidence. Research indicates that similarity learning is forward-looking; it transforms perceptions of reality by highlighting similarities between groups, reduces reliance on stereotypes, restrains the opposition of groups to each other on the "us-versus-them" mindset, and improves attitudes towards stigmatized groups (Galinsky & Moskowitz, 2000). This comprehensive approach to correcting biases within CBT – which encompasses a variety of methods and techniques – demonstrates high effectiveness.

Schema therapy is a modern, scientifically supported method of psychotherapy. It is an integrative direction that combines elements from various therapeutic modalities, including CBT, attachment theory, gestalt therapy, object relations, constructivism, and psychodynamic therapy. The schema therapy model is grounded on the concept of modes, which reflects how a person's dissociation, "splitting" between its internal modes occurs as a result of a chronic psycho-traumatic experience. The presence of dysfunctional schemas and modes leads to a maladaptive perception of the world.

Schema therapy (ST) is grounded on the idea of early maladaptive schemas (EMS), which are deeply ingrained patterns of thinking, emotions, and behavior developed during childhood in response to adverse conditions. These schemas are highly persistent and affect every aspect of an individual's life, influencing their interaction with the environment (Kellogg & Young, 2006).

EMS develop when a child's basic emotional needs are unmet or through traumatic experiences. To manage these adverse conditions, children often adopt coping styles – such as overcompensation, surrender, or avoidance. Although these strategies provide initial survival value, they can evolve into entrenched dysfunctional patterns that hinder adaptation in adulthood (Videler et al., 2020).

The objective of Schema Therapy (ST) is to assist clients in recognizing and altering their early maladaptive schemas (EMS). This process includes identifying ineffective coping styles, fostering healthier ways of engaging with the world, and correcting negative schemas (Ataei et al., 2024; Sempértegui et al., 2013).

In schema therapy, a combination of cognitive, experiential, behavioral, and interpersonal techniques is employed.

Cognitive techniques in schema therapy focus on modifying dysfunctional schemas by reassessing and replacing irrational beliefs. One of the

key techniques involves checking the reality of the schema. The therapist and client work together to analyze evidence that supports or contradicts the schema, collecting information from both the past and present. This process facilitates the individual to recognize that their schema is not an accurate reflection of reality but is often the result of information distortion.

Reformulation of evidence is another important cognitive technique. It involves searching for alternative explanations for situations that align with a client's schema. By doing this, the client can realize that there are different ways to interpret events that do not underpin their negative beliefs.

Evaluating coping styles, in turn, allows the client to understand their typical reactions to the activation of the schemes. By analyzing the advantages and disadvantages of their own coping styles, the client can identify how they either support their existing schemes or impede personal growth and change.

Other cognitive techniques include engaging in dialogue between the healthy aspects of one's personality and the maladaptive schemas, using reminder cards, and maintaining a schematic diary. These methods assist clients in developing effective thought processes and behaviors, while also consolidating new cognitive patterns (Young et al., 2006).

Experiential techniques are based on using the client's experiences to identify and modify early maladaptive schemas. Through imaginative techniques and dialogues, the therapist assists the client in recreating emotionally significant childhood situations and connecting them to current issues. This process enables a deeper understanding of the origins of these schemas and their influence on present life.

Experiential schema therapy techniques also include methods for activating emotions tied to early schemas. A key tool in this process is working with images, where the client, guided by the therapist, gradually transitions from neutral images to traumatic ones. This contributes to the identification and processing of deep emotional experiences, allowing clients to better realize the impact of early traumas on current behavioral patterns and interpersonal interactions.

Other experiential techniques encompass re-parenting, working with traumatic memories, and writing letters to significant people from the past. These approaches allow an individual to re-experience old emotions in a new way, achieve emotional release, and alter destructive behavior patterns (Young et al., 2006).

Behavioral techniques in schema therapy focus on actively modifying the behavior patterns that reinforce maladaptive schemas. This approach suggests developing and implementing new, more functional behaviors. The therapist assists the client in creating a detailed action plan that outlines specific tasks and strategies for completing them. Regularly assessing progress and

making necessary adjustments is also a crucial aspect of this process along the way.

One of the key elements of behavioral techniques is the emphasis on lifestyle changes. Clients are encouraged to analyze their choices, environments, and social connections to identify factors that support negative patterns. The therapist assists in developing strategies to gradually modify these aspects. An essential part of this process is motivation, which is fostered by highlighting the benefits of adopting new behavior patterns and discussing specific steps for their implementation.

A variety of methods can be employed to consolidate new skills, including role-playing, visualization, and journaling. Additionally, homework assignments are designed to facilitate the practical application of these new skills in real-life situations. Regularly analyzing the outcomes of these tasks helps identify challenges and correct ineffective strategies (Young et al., 2006).

By concentrating on specific actions and habits, this approach enables gradual changes in an individual's patterns of interaction with the environment and discovering new, more effective behaviors. The development of a detailed action plan aims to replace stereotypical reactions with more flexible and open responses. Through regular practice of these new skills in real-life situations, individuals can gradually reshape their established stereotypes.

Interpersonal techniques are essential in the process of change within schema therapy. Through empathic confrontation, the therapist assists the client in realizing the impact of schemas on the client's reactions, and limited re-parenting ensures that the client's actual needs are addressed within a safe therapeutic framework. This approach allows clients to overcome the emotions linked to early trauma and foster the development of healthier ways to engage with their environment. Thus, the therapeutic relationship becomes not only a tool for identifying and understanding schemas but also a basis for their transformation (Young et al., 2006).

Through empathic confrontation, the therapist helps clients understand how early maladaptive schemas influence their perceptions of gender roles and stereotypes. Thus, therapeutic relationships can serve as a foundation for developing adaptive models of interaction with people and contribute to overcoming prejudices.

Results

Empirical studies indicate a growing trend towards an eclectic approach in psychotherapeutic practice. Research conducted by Jensen et al. (1990) reveals that 68% of mental health professionals identify as eclectic, while 5% report using a

combination of cognitive, behavioral, and systems theory approaches (Jensen et al., 1990). This underscores the importance of integrating cognitive behavioral therapy (CBT) and schema therapy (ST) when addressing issues related to gender bias.

A study conducted by Ataei et al. (2024) confirmed that both schema therapy and the modification of cognitive biases are effective in reducing test anxiety among adolescents. The results revealed a statistically significant decrease in anxiety levels in the experimental groups compared to the control group. The researchers also noted a positive impact of both therapeutic approaches on cognitive processes, including reaction time and attention bias (Ataei et al., 2024).

Extrapolating this data to the issue of gender biases, and considering the common cognitive nature of the phenomena studied, it can be inferred that integrating Cognitive Behavioral Therapy (CBT) and schema therapy may effectively address gender stereotypes. Schema therapy focuses on identifying and processing early experiences that have shaped dysfunctional cognitive schemas related to gender, while CBT techniques help transform current automatic thoughts about gender roles.

The proposed integrative model for correcting gender bias includes specific techniques from both approaches that operate at various levels of cognitive organization. This model is structured into three interrelated levels:

1. The level of automatic thoughts (CBT).
2. The level of deep beliefs (Schema Therapy).
3. Integrative techniques.

Each of these levels includes a specific set of therapeutic techniques.

At the level of automatic thoughts, which is part of Cognitive Behavioral Therapy (CBT), the primary tool used is cognitive restructuring of gender stereotypes. The "Judgment Opinion" technique allows clients to view their gender biases from an outside perspective, analyzing the evidence "for" and "against" specific beliefs. Additionally, behavioral experiments enable clients to empirically test the validity of their gender biases by engaging in structured interactions with individuals of different genders under controlled conditions.

The "Advantages and Disadvantages" technique enhances our understanding of gender attitudes by analyzing their positive and negative aspects. Keeping a diary of automatic thoughts, particularly regarding gender stereotypes, helps identify and monitor patterns of biased thinking in daily life.

At the level of deep-seated beliefs addressed through schema therapy methods, the work begins with diagnosing early maladaptive schemas related to gender identity. This allows for the identification of core beliefs formed in childhood under the influence of family and society. The mode technique helps to understand different aspects of gender behavior through the lens of internal parts of the personality (for example, the "internal critical part" may uphold rigid gender stereotypes). Imaginative techniques create the opportunity for the

correction of traumatic experiences that have influenced the formation of gender biases, through a fictional dialogue with significant figures from the past. Empathetic confrontation allows for a gentle resistance to dysfunctional gender schemas, acknowledging their protective function while demonstrating their limiting impact on current life.

Integrative techniques combine elements from both therapeutic approaches, resulting in a complex therapeutic effect. The process begins with psychoeducation, which provides clients with foundational insights into how gender stereotypes develop and persist, drawing on both cognitive models and schema theory. This awareness prepares clients for deeper work. The modification of attention bias is then achieved through a combination of cognitive exercises and emotional processing, enabling the transformation of automatic patterns in the perception of gender differences. Similarity programs focus on developing empathy through the awareness of shared human characteristics, regardless of gender, which contributes to overcoming gender discrimination. The Socratic dialogue, enriched with elements of schema therapy, helps explore the deep roots of gender biases through a system of targeted questions that consider both rational and emotional aspects of the problem.

An important aspect of the proposed model is its systematic and phased implementation. At the initial stage, the focus is on raising awareness and identifying gender biases through psychoeducation and cognitive techniques. The next stage involves in-depth work with early schemas and traumatic experiences that support gender stereotypes. The final stage focuses on integrating new experiences and developing adaptive behavioral patterns.

Such a comprehensive model provides not only the correction of superficial manifestations of gender biases but also transforms the deep mechanisms of their formation and maintenance. The integration of cognitive-behavioral and schema therapeutic techniques creates a synergistic effect, enhancing the effectiveness of therapeutic impact and ensuring the sustainability of changes achieved.

Description of the integrative program

Based on our theoretical analysis and recognizing the need for an integrated approach to addressing gender biases, we have developed a psychological correction program that combines cognitive-behavioral therapy and schema therapy. This combination is chosen for its proven effectiveness in addressing deep beliefs and dysfunctional personality schemes (Al-Roubaiy, 2020) as well as the possibility of their complementary use. Cognitive-behavioral

therapy is effective for tackling the actual manifestations of prejudice at the level of thoughts and behaviors (Toner, 1994), while schema therapy provides access to the deep underlying patterns that contribute to the formation of these biases (Martin et al., 2002).

The program is designed based on contemporary research regarding the development of gender schemas (Bem, 1981; Starr & Zurbriggen, 2017) and the cognitive mechanisms that support them. Special emphasis is placed on integrating a feminist perspective (Vatcher & Bogo, 2001) alongside emotionally focused techniques. This approach fosters a more comprehensive manner for addressing and correcting gender biases.

The program consists of 12 sessions organized into four consecutive stages, each with specific objectives and methodologies. Let us consider the methodological support for each stage in more detail.

Table 1. Stages of the Gender Bias Correction Program

Stage	Duration	Purpose	Main tasks
1. Diagnostic-motivational	2 sessions	Diagnosis of gender biases and formation of motivation for change	Assessment of existing biases Detection of early maladaptive schemes Formation of motivation Defining individual goals
2. Cognitive-behavioral	4 sessions	Modification of dysfunctional cognitions and behavioral patterns	Working with automatic thoughts Conducting behavioral experiments Cognitive restructuring Development of new behavioral patterns
3. Schema-therapeutic	4 sessions	Transformation of deep schemas and modes	Identification and operation of modes Emotional processing Schema transformation Correction of interpersonal patterns
4. Integrative-consolidating	2 sessions	Consolidation of results and relapse prevention	Creating action plans Self-support strategies Monitoring changes Development of independence

A comprehensive review of the methodological framework behind the gender bias correction program is presented below:

The diagnostic-motivational stage is based on methods of psychological diagnostics, psychoeducation, and motivational interviewing. Key techniques include surveys, creating a bias impact map, and early schema questionnaires. This stage aims to achieve awareness of one's own biases, understanding their impact, and fostering readiness for change.

The cognitive-behavioral stage is implemented through methods of cognitive restructuring, behavioral experiments, and attention training. Techniques

like thought diaries, Socratic dialogue, and role-playing games are utilized. The result includes changes in dysfunctional beliefs, the development of new behavioral patterns, and an enhancement in empathy.

The schema-therapeutic stage incorporates schema mode techniques, imaginative techniques, and emotional learning. It utilizes dialogue of modes, rescripting of recollections, and empathic confrontation techniques. The objective is to transform schemas, improve emotional regulation, and develop new coping strategies.

The integrative-consolidating stage focuses on methods for integrating experiences, preventing relapse, and planning. It employs techniques to create further action plans, promote self-support, and monitor changes. This stage ensures the consolidation of results, the sustainability of changes, and the development of independence.

Limitations of the Study

The theoretical nature of the developed program imposes a primary limitation on the research, as the lack of empirical validation prevents an assessment of its practical effectiveness. The absence of a pilot implementation makes it impossible to identify potential challenges in executing the program and adapting it to real conditions. Furthermore, the program requires additional development to be effectively implemented across different cultural contexts and with diverse target groups. Another limitation is the lack of a longitudinal study, which would help evaluate the sustainability of the changes achieved.

Strengths of the study

The research is characterized by a comprehensive approach to the issue of gender bias through the integration of two evidence-based therapeutic modalities: cognitive-behavioral therapy and schema therapy. A clear program structure has been developed, with detailed descriptions of each stage, specific techniques, and methods, allowing for consideration of both superficial cognitive processes and deep personal schemas. A significant advantage of this study is its incorporation of contemporary research alongside a feminist perspective, which fosters a thorough understanding of gender bias and effective strategies for correcting them.

Practical implications

The practical value of this study lies in the creation of a comprehensive program aimed at correcting gender biases, designed for use by psychologists and psychotherapists in their work with clients. The methodological recommendations and specific techniques developed can be adapted for both group work and training programs. The social significance of the study is determined by its contribution to developing more effective approaches to overcoming gender discrimination in society and promoting egalitarian gender relations.

Conclusions and directions for future research

The developed integrative program for correcting gender biases is a scientifically grounded approach aimed at transforming dysfunctional gender stereotypes through a combination of methods of cognitive-behavioral therapy and schema therapy. The proposed model embodies core humanistic principles by treating gender bias correction not merely as symptom reduction, but as a process of human liberation and self-actualization. This approach recognizes that overcoming gender stereotypes is fundamentally about reclaiming one's authentic self and developing the capacity for genuine, non-prejudicial relationships with others regardless of gender identity. Theoretical analysis confirms the feasibility of this integration, considering the complex nature of gender biases that are formed at various levels of an individual's cognitive organization.

The program provides a systematic correction process that addresses both the actual manifestations of biases and the transformation of underlying thought schemes. It places special emphasis on raising awareness of one's own prejudices while promoting the development of new, more adaptive models for perceiving gender differences.

Future research should focus on empirically verifying the program's effectiveness, developing specific protocols tailored to various target groups and cultural contexts, and conducting longitudinal studies to evaluate the sustainability of the achieved changes. Another important direction of future work is adapting the program for group formats and designing methodological materials to train specialists for its implementation.

Declarations

Authors' Note:

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Author Contributions:

Tetyana V. Ivanova: Conceptualization, Supervision, Methodology, Writing - Review & Editing, Project Administration.

Anastasiia Lushchyk: Conceptualization, Investigation, Writing - Original Draft, Formal Analysis.

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Public Significance Statement

This research addresses the critical social issue of gender bias by proposing an innovative therapeutic intervention that combines cognitive behavioral and schema therapy approaches. The practical implications extend to educational settings, workplace diversity training, and clinical practice, potentially reducing systemic discrimination and promoting gender equality. By targeting both surface-level cognitive distortions and deep-rooted personality schemas, this integrative model offers mental health professionals, educators, and organizational consultants a comprehensive framework for addressing one of society's most persistent forms of structural oppression.

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CAN COGNITIVE FLEXIBILITY SERVE AS A CRITICAL BRIDGE BETWEEN IMPULSIVITY AND LONELINESS?

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Abstract
In this study, it was aimed to test the theoretical model developed about the mediating role of cognitive flexibility in the relationship between impulsivity and loneliness. This study, which was designed based on the correlational model, included a sample group of 459 secondary school students, 228 girls (49.7%) and 231 boys (50.3%). Demographic Information Form, Barrat Impulsivity Scale-11, Cognitive Flexibility Scale and Children's Loneliness Scale were used as data collection tools. According to the correlation analysis, it was determined that there was a positive relationship between impulsivity and loneliness, and a negative relationship between cognitive flexibility with impulsivity and loneliness. According to the results of the Structural Equation Model analysis, cognitive flexibility mediates the relationship between impulsivity and loneliness. This study can be a resource for school mental health professionals in the planning of protective and preventive intervention studies.

Keywords: Impulsivity, loneliness, cognitive flexibility, adolescence.

Introduction

Humans are inherently social beings who depend on interpersonal relationships to maintain psychological and emotional well-being. Social connections provide individuals with emotional support, facilitate identity development, and foster a sense of belonging that is fundamental for healthy development. When these social expectations are not fulfilled, individuals may

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experience feelings of social disconnection that can negatively affect their psychological adjustment. One of the most prominent emotional experiences associated with perceived social disconnection is loneliness. Loneliness is commonly defined as a distressing subjective experience that arises from a perceived discrepancy between desired and actual social relationships (Peplau & Perlman, 1982). Unlike objective social isolation, loneliness reflects individuals' cognitive and emotional evaluations of their social relationships (Cacioppo & Hawkley, 2009). The theoretical framework proposed by Hawkley and Cacioppo (2010) has been particularly influential in loneliness research, as it emphasizes the psychological and physiological mechanisms underlying perceived social isolation and highlights its broad consequences for well-being. From this perspective, loneliness is not merely the absence of social interaction but rather a complex psychological state shaped by individuals' interpretations of their social experiences.

Although loneliness has traditionally been studied more extensively in older adult populations, a growing body of research suggests that adolescents are also particularly vulnerable to experiencing loneliness (Cooper et al., 2021; Hawthorne, 2007; Heinrich & Gullone, 2006). Adolescence represents a critical developmental stage characterized by increasing importance of peer relationships, identity formation, and the development of a sense of belonging (Laursen & Hartl, 2013). During this stage, weak peer and family relationships, disruptions in social interactions, and difficulties in interpersonal functioning constitute significant risk factors that increase the likelihood of experiencing loneliness. In this regard, adolescents who lack strong and supportive social bonds are more likely to report higher levels of loneliness (Zhang & Dong, 2022). Furthermore, difficulties in emotion regulation, managing social stressors, and establishing and maintaining stable social relationships may further intensify perceived social isolation (Lodder et al., 2016; Von Soest et al., 2020). In addition to interpersonal factors, school-related experiences also play a significant role in adolescents' social adjustment. A positive sense of school belonging and successful adaptation to the school environment have been shown to reduce feelings of loneliness among students (Benner, 2011; Liu et al., 2019).

Loneliness during adolescence has been associated with a wide range of negative psychological and health-related outcomes. Research indicates that persistent loneliness is linked to poorer physical health and sleep disturbances (Eccles et al., 2020; Levine, 2012), as well as increased symptoms of depression and anxiety (Baytemir & Yıldız, 2017; Loades et al., 2020). Additionally, loneliness has been related to higher levels of suicidal ideation among adolescents (Stickley & Koyanagi, 2016). Longitudinal studies also suggest that chronic loneliness may be associated with increased health risks later in life (Tanskanen & Anttila, 2016). Considering its broad impact on psychological and social functioning, identifying

the factors that contribute to loneliness during adolescence has become an important focus of research (Qualter et al., 2015).

Understanding the mechanisms underlying loneliness requires examining individual cognitive and behavioral characteristics that shape social experiences. In particular, self-regulatory processes may play a key role in determining how adolescents interpret and respond to interpersonal situations. Social Cognitive Theory provides a useful theoretical framework for understanding these processes. According to Bandura (1986), human behavior is shaped through the reciprocal interaction of personal factors, behavioral patterns, and environmental influences. This process, referred to as triadic reciprocal causation, suggests that individuals actively influence their own development through cognitive and behavioral self-regulation.

Self-regulation plays a central role in adolescents' ability to manage emotions, control impulses, and adapt their behavior in social contexts. Deficiencies in self-regulatory processes may lead to difficulties in social functioning and increase vulnerability to social isolation and loneliness (Trentacosta & Shaw, 2009). Within this framework, impulsivity and cognitive flexibility represent two psychological constructs that may be particularly relevant for understanding adolescents' experiences of loneliness.

Impulsivity is a multidimensional construct characterized by a tendency to act without sufficient forethought and to prioritize immediate rewards over long-term consequences (Beauchaine et al., 2017; Hamilton et al., 2015). Specifically, impulsivity is thought to involve several processes, including: 1) reduced ability to collect and evaluate information before reaching decisions (i.e., impulsive decision making); and 2) reduced ability to stop motor responses that have already begun or become prepotent (i.e., response inhibition) (MacPherson et al., 2022). Impulsivity is typically conceptualized as comprising several interrelated dimensions, including difficulties in sustaining attention, acting without sufficient deliberation, and a lack of future-oriented planning (Patton et al., 1995). These dimensions reflect different but interrelated aspects of impulsive behavior, demonstrating that impulsivity is a complex construct involving cognitive, behavioral, and attentional components. Impulsivity is also conceptualized as a deficit in self-regulatory capacity, reflecting difficulties in inhibiting inappropriate responses and delaying gratification. From a neurocognitive perspective, it is closely associated with impairments in executive functions, particularly inhibitory control and decision-making processes (Leshem & Yefet, 2019). Within the framework of Social Cognitive Theory, impulsivity can be understood as a limitation in self-regulatory processes that may hinder individuals' ability to monitor and regulate their behavior in accordance with social expectations (Bandura, 1986).

Adolescence is a developmental stage in which impulsive tendencies often intensify due to the incomplete maturation of the prefrontal cortex and increased sensitivity to reward-related stimuli (Khurana et al., 2018; Leshem, 2015). A

growing body of research indicates that impulsivity during this period is associated with various high-risk behaviors (Zanus et al., 2021). These behaviors include poor academic performance, substance use, problematic internet use, aggression, self-harm, eating disorders, and risky sexual behaviors (Balevich et al., 2013; Bardone-Cone et al., 2016; Curry et al., 2017; Hasking & Claes, 2020; Kozak et al., 2018; Odaci & Berber-Celik, 2016). Beyond its intrapersonal consequences, impulsivity can also impair social functioning by limiting individuals' ability to regulate emotional responses, accurately interpret social cues, and respond appropriately in interpersonal contexts (DeBono et al., 2010). Adolescents with high impulsivity may experience difficulties in forming and maintaining social relationships due to limited self-regulation, reduced empathic responsiveness, and maladaptive interpersonal behaviors (Baldner et al., 2015; Tan et al., 2017). These difficulties may weaken interpersonal relationships and increase the likelihood of negative peer interactions and social rejection, thereby elevating the risk of loneliness (Vanhalst et al., 2013). Recent studies increasingly emphasize the role of impulsivity in social maladjustment and loneliness, suggesting that deficits in impulse control can impair peer relationships and increase social withdrawal (Carvalho et al., 2023; Hu et al., 2026; Jong et al., 2024).

Cognitive flexibility is a core executive function that enables individuals to shift cognitive sets, adapt to novel situations, and develop alternative strategies when confronted with challenges (Dennis & Vander Wal, 2010). It reflects the capacity to re-evaluate and restructure thoughts, behaviors, and beliefs in response to changing circumstances, rendering it indispensable for adaptive functioning. Rooted within the framework of Social Cognitive Theory (Bandura, 1986), cognitive flexibility operates as a crucial self-regulatory mechanism that drives social learning, decision-making, and behavioral adaptation. Adolescents demonstrating high cognitive flexibility are better equipped to navigate complex social environments, resolve interpersonal conflicts, and cognitively reinterpret negative social experiences. Conversely, those with deficits in cognitive flexibility often exhibit rigid thinking patterns, struggle with perspective-taking, and respond maladaptively to social stressors, thereby exacerbating their vulnerability to loneliness (Boman et al., 2017; Ortega-Jiménez et al., 2021). Furthermore, heightened impulsivity is frequently associated with diminished cognitive flexibility, as it can constrain the executive control mechanisms requisite for adaptive thought regulation (Chamberlain et al., 2006; Coumans et al., 2018). Given that empirical evidence links robust cognitive flexibility to reduced levels of perceived loneliness (Kökcam et al., 2024), this executive function appears to serve a critical protective role. Consequently, it is plausible to conceptualize cognitive flexibility as a key mediator between impulsivity and loneliness. By buffering the deleterious effects of impulsive tendencies on social well-being, enhancing cognitive flexibility could equip adolescents with more effective coping strategies and foster more resilient social connections.

The Present Study

Adolescent loneliness has been predominantly studied in isolation from impulsivity and cognitive flexibility, leaving a gap in understanding how these constructs interact. Specifically, there is a lack of research examining the combined influence of impulsivity and cognitive flexibility on loneliness, as well as the potential mediating role of cognitive flexibility. Addressing this gap is particularly important, as adolescence represents a critical period of social, emotional, and cognitive development, during which individuals are highly susceptible to social stressors and maladaptive coping strategies. Investigating loneliness through the lens of multiple psychological factors offers an opportunity to broaden the conceptual understanding of this construct in youth populations and to highlight its relevance for adolescent mental health. Furthermore, understanding the interplay between impulsivity, cognitive flexibility, and loneliness has practical implications for informing school-based mental health initiatives, guiding the design of group intervention programs, and supporting the development of adaptive coping skills among adolescents.

Building on these considerations, the present study aims to test a model in which cognitive flexibility mediates the relationship between impulsivity and adolescent loneliness. This approach allows for a more nuanced exploration of the mechanisms through which impulsive tendencies may contribute to social and emotional difficulties, and how cognitive flexibility might buffer these effects. Accordingly, the following hypotheses were formulated:

H1: Impulsivity has a significant direct effect on cognitive flexibility.

H2: Cognitive flexibility has a significant direct effect on loneliness.

H3: Impulsivity has a significant direct and indirect effect on loneliness, mediated by cognitive flexibility.

Method

Participants

The sample consisted of 459 middle school students (228 females, 49.7%; 231 males, 50.3%) attending two public schools in the eastern region of Türkiye. Participants were in 6th, 7th, and 8th grades (24.4%, 28.8%, and 46.8%, respectively) and ranged in age from 12 to 14 (Mean = 12.63, *SD* = 0.74). Both schools served students primarily from the middle socioeconomic status (74.8%) and were located in urban areas reflecting a moderate level of cultural diversity.

Table 1. Statistics with demographic information

Gender	***f***	***%***	***M.***	***SD***	**Parents Togetherness**	***f***	***%***
Girl	228	49,7			Living together	431	93,8
Boy	231	50,3			Divorced	6	1,4
Total	459	100	12,63	0,74	Living separately	22	4,8
Grade Level	***f***	***%***			**Mother's Education Status**	***f***	***%***
6th grade	112	24,4			Illiterate	19	4,2
7th grade	132	28,8			Primary-secondary school	306	66,7
8th grade	215	46,8			High school and above	134	29,1
Family socioeconomic status	***f***	***%***			**Father's Education Status**	***f***	***%***
Income is less than expenses	53	11,6			Illiterate	12	2,6
Income is equal to expenses	348	75,8			Primary-secondary school	240	52,2
Income is greater than expenses	58	12,6			High school and above	207	45,2

Notes: M = Mean, *SD* = Standard Deviation

Procedure

This cross-sectional study received ethical approval from the university's ethics committee prior to data collection. Informed consent was obtained from both the school administration and the participants' parents. The study was conducted under the supervision of the researchers, during regular class hours, using a paper-and-pencil format. Participation was voluntary, and confidentiality of responses was ensured.

Measurements

The selection of measurement instruments was based on both their theoretical relevance and established psychometric properties in adolescent samples, particularly in the Turkish context. Across all measures, participants completed the same questionnaires, including measures of sociodemographic information (e.g., age, gender, and grade level), impulsivity, cognitive flexibility, and loneliness. Cronbach alpha values of .60 and above were accepted as reliable for the measurement instruments (Hair et al., 2014).

Impulsivity

The Barratt Impulsivity Scale-11 (BIS-11) was developed by Patton et al. (1995) to measure the tendency of individuals to act without controlling their thoughts and behaviors. Adapted into Turkish by Gülec et al. (2008), the scale is a 4-point Likert type and consists of 30 items. BIS-11 conceptualizes impulsivity with three subscales: Attention and Cognitive Disorder (e.g., “I act without thinking”), Motor Impulsivity (e.g., “I act on impulse”), and Self-Control and Planning (e.g., “I plan my tasks carefully”). Higher scores reflect greater impulsivity. In this study, internal consistency coefficients were measured using Cronbach Alpha. This coefficient was .77, .61, and .68 for the subscales, respectively, and .80 for the total scale. The construct validity of the Turkish version of the BIS-11 has been supported by factor analytic findings consistent with the original structure, its ability to distinguish between clinical and non-clinical groups, and its significant correlations with related constructs such as aggression, personality traits, and anger (Gülec et al., 2008). These findings indicate that the scale demonstrates acceptable construct validity.

Cognitive Flexibility

The Cognitive Flexibility Scale (CFS) was developed by Bilgin (2009) to assess individuals' ability to adapt their thinking and behavior in response to changing circumstances. Originally developed in Turkish, the scale consists of 19 items and a single dimension, rated on a 6-point Likert scale, comprising bipolar adjective pairs (e.g., "successful/unsuccessful," "unliked by everyone/liked by everyone"). Higher scores indicate greater cognitive flexibility. In this study, the Cronbach's Alpha coefficient was found to be .90. The construct validity of the Turkish version of this scale was supported by factor analysis revealing a two-factor structure explaining 41.38% of the total variance (Alternatives: 13 items; Control: 7 items). Confirmatory factor analysis showed good model fit (GFI = .91, CFI = .93, RMSEA = .06) and demonstrated criterion validity through significant negative correlations with depression and anxiety, and a positive correlation with life satisfaction (Bilgin, 2009).

Loneliness

Children’s Loneliness Scale was developed by Asher and Wheeler (1985) to assess students' perceived social isolation and lack of connection in the school environment. Adapted into Turkish by Kaya (2005), the scale consists of 23 items and a single dimension, rated on a 5-point Likert scale (e.g., "I feel lonely at school"). Higher scores reflect higher perceived loneliness. In this study, the internal consistency coefficient was determined to be .88. The construct validity of the

Children's Loneliness Scale was supported by factor analysis findings indicating a unidimensional structure and an acceptable level of variance explained by the first factor. After removing items with low factor loadings, the scale was considered a valid measurement tool with a 15-item structure for students in grades 5–8 (Kaya, 2005).

Data Analytic Plan

Statistical analyses were conducted using SPSS 23.0 and IBM Amos Graphics 24.0. Prior to the analyses, the dataset was examined to ensure the necessary assumptions were met (Kline, 2016). Missing data analysis, outlier analysis, normality, multicollinearity, linearity, and covariance checks were performed. From the initial 499 responses, three cases with substantial missing values were excluded. Univariate outliers were identified by converting values to Z scores; 32 cases outside the ±3.00 range were removed. Multivariate outliers were detected using the Mahalanobis Distance (D^2), and eight cases with significance levels below .05 were excluded. Before testing normality, a parcellation procedure was applied to reduce measurement error and meet multivariate normality. For unidimensional constructs (cognitive flexibility and loneliness), parcels were created using the balancing method (Little et al., 2013). After parcellation, skewness and kurtosis values for the remaining 459 cases were within ±1.00, indicating normal distribution (Hair et al., 2014). Multicollinearity was assessed via pairwise correlations, Durbin-Watson statistic, tolerance values, and variance inflation factor (VIF). Correlations were below .80, the Durbin-Watson value (1.75) was within the acceptable range, all tolerance values were above .20 (.59–.83), and the highest VIF (1.70) was well below 4, indicating no multicollinearity (Field, 2013; Hair et al., 2014). Linearity was confirmed through probability–likelihood plots, curve estimation, and P–P diagrams, where residuals were evenly distributed along the line. Covariance assumptions were met as scatter plots showed rectangular distribution and standardized residuals were within ±3.12.

After determining that all assumptions were met, the measurement model was analyzed first, followed by the structural equation model. Mediation was tested using structural equation modeling with impulsivity as the independent variable, cognitive flexibility as the mediating variable, and loneliness as the dependent variable. Impulsivity was represented by the total score of the BIS-11, whereas cognitive flexibility and loneliness were modeled as latent variables using parcels created from their respective scale items (Little et al., 2013). These operationalizations allowed for the analysis of the mediating effect between the variables of impulsivity, cognitive flexibility, and loneliness. Bootstrap method (5000 resamples, 95% confidence interval) was applied to examine indirect effects,

and confidence intervals were considered significant when they did not include zero (Baron & Kenny, 1986; Preacher & Hayes, 2008). Model fit was assessed using $\chi^2/df < 3$, GFI, AGFI, NFI, and CFI > .85, and RMSEA and SRMR < .08 (Byrne, 2010; Kline, 2016; Tabachnick & Fidell, 2015). This study is not previously registered. Data and analysis outputs are available from the corresponding author upon request.

Results

Descriptive Statistics

Correlation analyses indicated that loneliness was positively and significantly associated with total impulsivity ($r = .38$, $p < .01$), attention and cognitive dysregulation ($r = .37$, $p < .01$), motor impulsivity ($r = .25$, $p < .01$), and self-control and planning ($r = .26$, $p < .01$). In contrast, loneliness was negatively and significantly correlated with cognitive flexibility, the proposed mediator ($r = -.44$, $p < .01$). Similarly, cognitive flexibility showed significant negative correlations with total impulsivity ($r = -.41$, $p < .01$), attention and cognitive dysregulation ($r = -.40$, $p < .01$), motor impulsivity ($r = -.24$, $p < .01$), and self-control and planning ($r = -.31$, $p < .01$). Descriptive statistics and correlations are presented in Table 2.

Table 2. Correlation coefficients of variables and descriptive statistics

	1	2	3	4	5	6
1.Loneliness	1					
2.Cognitive Flexibility	-.44**	1				
3.ACD	.37**	-.40**	1			
4.MI	.25**	-.24**	.52**	1		
5.SCP	.26**	-.31**	.50**	.39**	1	
6.Total Impulsivity	.38**	-.41**	.91**	.70**	.75**	1
Min	15	50	14	7	4	34
Max	54	95	43	20	29	85
Mean	26.38	81.60	25.10	12.26	19.69	57.04
SD	10.11	10.55	6.33	2.63	3.65	10.37
Skewness	.92	-.74	.40	.53	.14	.23
Kurtosis	-.11	-.08	-.47	.10	-.11	-.48

Notes: N = 459, ACD: Attention and Cognitive Dysregulation; MI: Motor Impulsivity; SCP: Self-Control and Planning. $^{**}p < .01$;

Mediation Test

Measurement Model

The measurement model included three latent variables (impulsivity, cognitive flexibility, and loneliness) measured with seven observed indicators. Model fit indices indicated good and acceptable fit: $\chi^2/df = 2.11$, $p = .016$; GFI = .986; AGFI = .965; NFI = .984; CFI = .992; RMSEA = .049; SRMR = .024 (Byrne, 2010; Kline, 2016; Tabachnick & Fidell, 2015). The measurement model is presented in Figure 1.

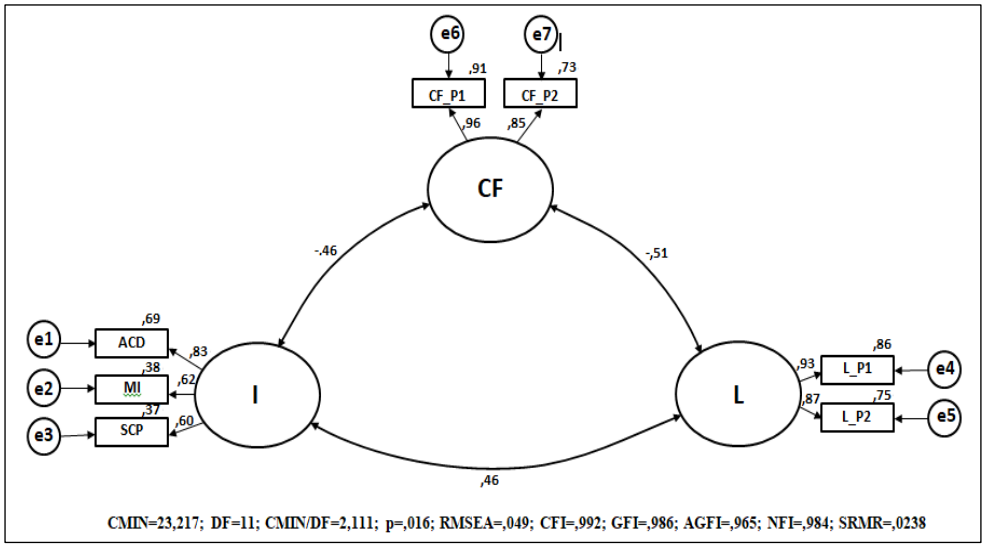


Figure 1: Standardized path coefficients calculated for the measurement model

Notes: I: Impulsivity; CF: Cognitive Flexibility; L: Loneliness, ACD: Attention and Cognitive Dysregulation, MI: Motor Impulsivity, SCP: Self-Control and Planning, CF_P1veP2: Cognitive Flexibility Plots, L_P1 and P2: Loneliness Plots. ***p* <0.001

Structural Model and Mediation Testing

All path coefficients in the structural model were statistically significant, supporting the proposed relationships among the latent variables. Accordingly, the mediation model was tested with all latent variables included. Detailed path coefficients are presented in Table 3. The structural model demonstrated good fit: $\chi^2/df = 2.11$; GFI = .986; AGFI = .965; CFI = .992; NFI = .984; RMSEA = .049; SRMR = .024 (Byrne, 2010; Kline, 2016; Tabachnick & Fidell, 2015).

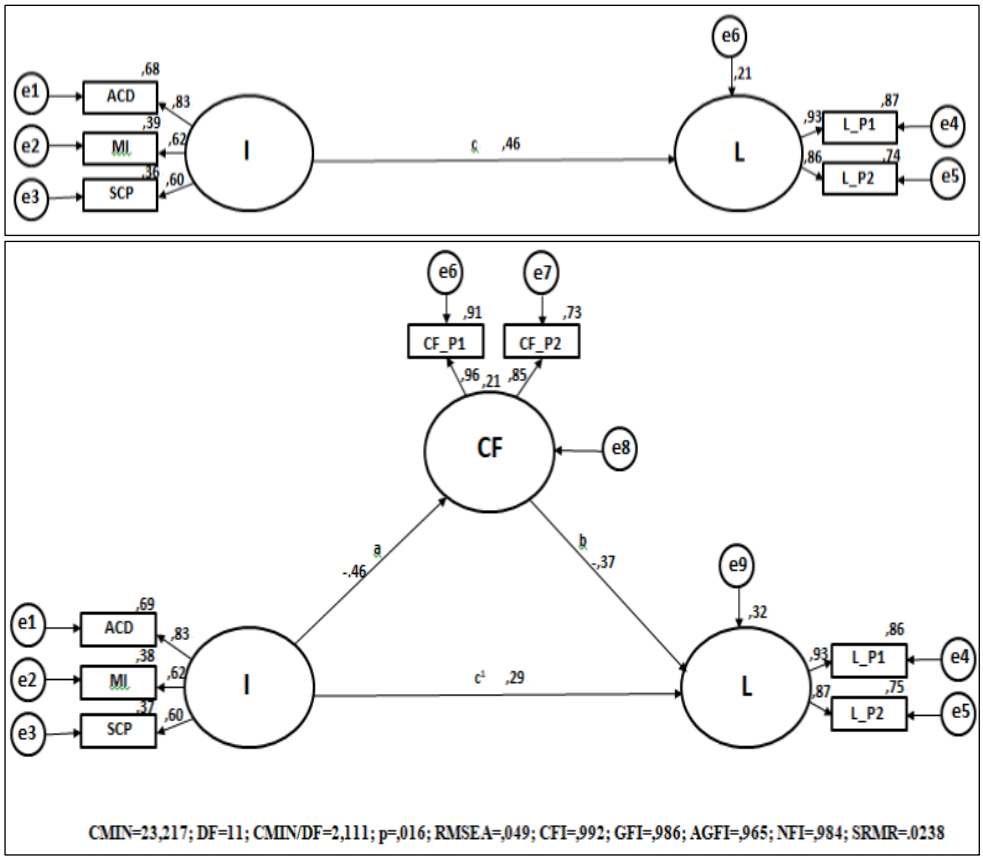


Figure 2: Mediation Model

Notes: I: Impulsivity; CF: Cognitive Flexibility; L: Loneliness, ACD: Attention and Cognitive Dysregulation, MI: Motor Impulsivity, SCP: Self-Control and Planning, CF_P1veP2: Cognitive Flexibility Plots, L_P1 and P2: Loneliness Plots. ***p* <0.001

Table 3. The mediating role of cognitive flexibility in the relationship between impulsivity and loneliness

				R^2	*SE*	λ	*% 95 CI*
Impulsivity	→	Loneliness	(c way)	.21	.06	.46**	
Impulsivity	→	Cognitive Flexibility	(a way)	.21	.06	-.46**	
Cognitive Flexibility	→	Loneliness	(b way)	.32	.05	-.37**	
Impulsivity	→	Loneliness	(c' way)	-	.06	.29**	
Indirect Effect			(ab)		-	.17**	.107 – .241

Notes: λ, Standardized regression coefficients; CI, Confidence Interval; SE, Standard Error. ***p* <0,001

When the hypotheses of the research were evaluated according to the results:

H1: Impulsivity had a significant direct effect on cognitive flexibility ($\lambda = -0.46$, $p < 0.001$), confirming Hypothesis 1.

H2: Cognitive flexibility had a significant direct effect on loneliness ($\lambda = -0.37$, $p < 0.001$), supporting Hypothesis 2.

H3: Impulsivity demonstrated both a significant direct effect on loneliness ($\lambda = 0.46$, $p < 0.001$) and a significant indirect effect through cognitive flexibility ($\lambda = 0.17$, 95% CI [0.107, 0.241]), confirming Hypothesis 3. The total effect of impulsivity on loneliness was also significant ($\lambda = 0.29$, $p < 0.001$).

Additionally, impulsivity accounted for 21% of the variance in cognitive flexibility ($R^2 = 0.21$) and 21% of the variance in loneliness ($R^2 = 0.21$). Through cognitive flexibility, impulsivity explained 32% of the variance in loneliness ($R^2 = 0.32$). These findings indicate that impulsivity affects loneliness both directly and indirectly via cognitive flexibility, while cognitive flexibility exerts a direct effect on loneliness.

Discussion

Previous research has indicated a relationship between impulsivity and loneliness, but there is limited evidence on the mechanisms underlying this link, particularly the potential mediating role of cognitive flexibility (Savci & Aysan, 2016; Stavrova et al., 2021). The present study addressed this gap by examining whether cognitive flexibility mediates the relationship between impulsivity and loneliness among adolescents, providing novel insights into the interplay between self-regulation, executive functioning, and social adaptation. The magnitude of the correlations ranged from small to moderate. According to conventional guidelines (Cohen, 1988), the relationship between impulsivity and loneliness ($r = .38$) can be considered moderate, while the association between cognitive flexibility and loneliness ($r = -.44$) also reflects a moderate effect size. These findings suggest that while the relationships are statistically significant, they represent meaningful but not strong associations, indicating the involvement of additional factors. Taken together, these findings highlight the role of cognitive flexibility as a potential mechanism linking impulsivity to loneliness, offering both theoretical and practical implications for adolescent development.

Consistent with Hypothesis 1, impulsivity has shown a significant and negative relationship with cognitive flexibility (Martin & Rubin, 1995; Moore & Malinowski, 2009; Odlaug et al., 2011). These results indicate that adolescents with higher levels of impulsivity tend to exhibit more rigid thought patterns and have difficulty adapting their thoughts and behaviors to changing social or academic demands. When evaluating this result from a neuropsychological perspective, it is

appropriate to address the concept of executive functions. Executive functions refer to a set of higher-order cognitive processes, including inhibitory control, working memory, and cognitive flexibility, that enable individuals to regulate their thoughts and behaviors in a goal-directed manner (Diamond, 2013; Miyake et al., 2000). From this perspective, impairments in executive functioning are likely to undermine cognitive flexibility. Impulsivity, in turn, is closely associated with deficits in executive functions, particularly in inhibitory control and cognitive regulation (Freis et al., 2022; Hu et al., 2026; Leshem & Altman, 2021). This relationship helps to contextualize the observed negative association between impulsivity and cognitive flexibility. From a Social Cognitive Theory perspective, impulsivity reflects deficits in self-regulatory processes, which may constrain the cognitive flexibility required for adaptive behavioral adjustments (Bandura, 1986). In this context, decreased self-regulation capacity can negatively impact the cognitive flexibility that allows adolescents to adjust their thoughts and behaviors in response to changing environmental demands. In daily life, this may manifest as difficulties in evaluating alternative perspectives. Adolescents may also struggle to adapt responses in peer interactions or regulate behavior according to situational demands. Although the observed associations are modest, they suggest that even small increases in impulsivity are linked to measurable decreases in cognitive flexibility among adolescents.

Consistent with Hypothesis 2, cognitive flexibility was found to be negatively and significantly associated with loneliness. This finding aligns with previous research (Frinking et al., 2019; Smith et al., 2020) and suggests that higher levels of cognitive flexibility are associated with lower levels of perceived loneliness. Adolescents with greater cognitive flexibility tend to demonstrate stronger communication and social skills, adapt more effectively to varying social contexts, and generate constructive solutions when interpersonal difficulties arise (Martin & Anderson, 2001; Odaci & Cikrikci, 2018; Romero-Lopez et al., 2018). In contrast, lower cognitive flexibility is associated with rigid thinking patterns, difficulties in perspective-taking, and reduced empathic capacity (Cai & Qi, 2023), which may hinder social adaptation and problem-solving. Adolescents who exhibit such rigidity may struggle to consider alternative viewpoints, respond flexibly in social interactions, and maintain effective interpersonal relationships. Consequently, these difficulties may increase the likelihood of social disconnection and feelings of loneliness.

The analyses revealed that impulsivity is associated with loneliness both directly and indirectly, supporting the study's 3. hypothesis. Consistent with previous research (Savci & Aysan, 2016; Stavrova et al., 2021), a direct, significant, and positive relationship was found between impulsivity and loneliness. Although empirical evidence on this link remains relatively limited, impulsive behaviors such as substance use, delinquency, and self-harm have been shown to co-occur with higher levels of loneliness (Curry et al., 2017; Stickley et al., 2014). From a social

cognitive perspective, impulsivity undermines key competencies such as observational learning, perspective-taking, foresight, and self-regulation, all of which are essential for navigating social interactions. These deficits may hinder adolescents' ability to conform to social norms, weaken interpersonal bonds, and increase the likelihood of social isolation (Findley et al., 2013). For instance, adolescents who struggle to follow classroom rules, interrupt others, or display aggressive or disruptive behaviors may be more frequently criticized by peers, teachers, and family members. Over time, the repetition of such behaviors can lead to peer rejection and exclusion, intensifying feelings of loneliness and limiting opportunities to form new social relationships.

Beyond the direct association between impulsivity and loneliness, the SEM analyses also revealed a significant indirect effect through cognitive flexibility, indicating its mediating role. This is consistent with recent research emphasizing cognitive flexibility as a protective factor that links individual traits to social adjustment outcomes in adolescence (Kökcam et al., 2024). Interpreted within Social Cognitive Theory (Bandura, 1986), this result underscores the dynamic interplay between personal characteristics, cognitive processes, and social experiences. While impulsivity can disrupt self-regulation and strain interpersonal relationships, cognitive flexibility serves as a protective mechanism that can attenuate these negative effects. Adolescents with higher cognitive flexibility are better able to reinterpret social situations, adjust to changing interpersonal demands, and regulate their emotional and behavioral responses more effectively.

Thus, impulsivity does not inevitably precipitate loneliness; rather, its impact is partially contingent upon the individual's level of cognitive flexibility. Adolescents with deficits in both self-regulation and flexible cognitive processing may be at heightened risk for feeling socially disconnected, whereas those with stronger cognitive flexibility may buffer the pathway from impulsivity to loneliness, supporting more adaptive social engagement. This interpretation is consistent with broader adolescent mental health literature demonstrating that higher cognitive flexibility is linked with better psychosocial adjustment and lower loneliness (Keleş et al., 2025).

Limitations and Future Research

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design limits the ability to infer causal relationships between impulsivity, cognitive flexibility, and loneliness. Longitudinal or experimental studies are needed to examine how these variables influence each other over time and to establish temporal precedence (Maxwell & Cole, 2007; Selig & Preacher, 2009). Second, the sample was drawn from two public

middle schools in the eastern region of Turkey and consisted of early adolescents aged 12–14. Therefore, the findings primarily reflect patterns specific to this developmental stage and may not fully generalize to middle or late adolescence or to adolescents from different cultural, socioeconomic, or geographical backgrounds. Future research should include more diverse and representative samples to enhance external validity and examine whether cultural or contextual factors moderate the observed relationships (Bornstein, 2017).

Third, all variables were measured using self-report questionnaires, which may be subject to social desirability bias and shared method variance. Incorporating multi-method approaches, such as behavioral tasks, ecological momentary assessments, or reports from parents and teachers, would strengthen the reliability and robustness of the findings (Podsakoff et al., 2003). Additionally, while this study focused on impulsivity and cognitive flexibility as key factors related to adolescent loneliness, other potentially important variables such as emotional regulation, psychological resilience, social support, and well-being were not included. Future studies could expand on this model by integrating these factors to provide a more comprehensive understanding of loneliness.

Finally, from an applied perspective, the findings suggest that interventions targeting cognitive flexibility and self-regulatory skills may help reduce loneliness among adolescents. Based on these findings, such interventions could include school-based programs, such as social-emotional learning curricula and peer-support initiatives, as well as CBT-based cognitive flexibility training that focuses on perspective-taking, adaptive problem-solving, and thought regulation exercises. These programs offer concrete strategies to enhance executive functioning, problem-solving, and adaptive coping skills, which could buffer the negative impact of impulsivity on social relationships, support more effective peer interactions, and reduce perceived social isolation (Zelazo & Carlson, 2012). Future research could evaluate the efficacy of such interventions through controlled trials to determine whether strengthening cognitive flexibility and self-regulation translates into measurable reductions in loneliness.

Conclusion

Adolescent loneliness remains underexplored despite its implications for mental health and social functioning. This study found that impulsivity was positively associated with loneliness, cognitive flexibility was negatively associated with loneliness, and impulsivity was indirectly associated with loneliness through cognitive flexibility.

These findings have theoretical and practical significance. Impulsive behaviors can increase loneliness by disrupting relationships and self-regulation.

Psychoeducational interventions in schools focusing on self-control, emotional regulation, and cognitive flexibility may reduce impulsivity, enhance adaptability, and support healthier social connections. Educators, counselors, and psychologists should prioritize strategies that strengthen both impulse control and cognitive flexibility to foster social and emotional development and mitigate loneliness during adolescence.

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THE IMPACT OF PERMA MODEL-BASED POSITIVE PSYCHOLOGICAL INTERVENTION ON PREOPERATIVE ANXIETY IN YOUNG FEMALE PATIENTS WITH LUNG CANCER UNDERGOING DAY SURGERY

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Abstract

To assess the efficacy and clinical value of a PERMA model-based positive psychological intervention for reducing preoperative anxiety and enhancing psychological outcomes in young female lung cancer patients undergoing day surgery.

This randomized controlled trial included 144 female patients aged 18–40 years with lung cancer scheduled for day surgery between March and June 2025. Patients were assigned to receive either PERMA-based intervention plus routine care (n =73) or routine care alone (n = 71). The primary outcome was preoperative anxiety measured by the Self-Rating Anxiety Scale (SAS). Secondary outcomes included depression, stigma, fear of cancer recurrence, fertility concerns, quality of life, social integration, health education acceptance, ERAS execution rates, and patient satisfaction. Between-group differences were analyzed using mean differences with 95% confidence intervals and Cohen's d; secondary outcomes were adjusted using the Holm-Bonferroni method.

Baseline characteristics were well-balanced between groups. After intervention, the intervention group had significantly lower anxiety, depression, stigma, and fear of cancer recurrence than the control group (all

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p <0.001). The intervention group also achieved higher scores for quality of life, subjective well-being, and social integration, along with reduced fertility concerns (all p <0.05). Most secondary outcomes remained significant after Holm-Bonferroni adjustment.
The PERMA model-based positive psychological intervention significantly and meaningfully reduces preoperative anxiety, while improving psychological well-being, quality of life, social integration, and perioperative engagement in young female lung cancer patients undergoing day surgery. It is suitable for integration into perioperative care for this vulnerable population.

Keywords: PERMA; psychological intervention; lung neoplasms; ambulatory surgical procedures; anxiety

Lung cancer remains a leading cause of cancer-related mortality worldwide, with increasing incidence among younger populations, particularly women (Li et al., 2025). In China, young female lung cancer patients, defined as those diagnosed between 18–40 years of age, constitute a distinct demographic characterized by unique biological, psychological, and social challenges (Tian et al., 2025). These patients primarily present with early-stage disease, predominantly adenocarcinoma, making surgical resection the treatment of choice (Malik et al., 2025). The advent of day surgery models, facilitated by enhanced recovery after surgery (ERAS) protocols and minimally invasive techniques, has revolutionized the surgical management of early-stage lung cancer (Che, 2020).

Despite these therapeutic advances, preoperative anxiety remains prevalent among lung cancer patients scheduled for surgical intervention. Studies indicate that approximately 48.4% of lung cancer patients undergoing video-assisted thoracoscopic surgery (VATS) experience high levels of preoperative anxiety (Ju et al., 2023). This anxiety is particularly pronounced in young female patients, who face compounded stressors including concerns about fertility preservation, altered body image, disrupted life trajectories, and fear of cancer recurrence (Smrke et al., 2020). The condensed timeline of day surgery, typically requiring discharge within 24–48 hours post-operatively, may further exacerbate patient anxiety and uncertainty regarding recovery (Dong et al., 2021).

Preoperative anxiety has been demonstrated to adversely affect multiple dimensions of surgical care. Elevated anxiety levels correlate with increased perioperative complications, prolonged hospital stays, impaired postoperative recovery, and diminished quality of life (Lu et al., 2025). Moreover, state anxiety immediately before surgery has been identified as a significant predictor of postoperative health-related quality of life, suggesting that timely psychological intervention could substantially improve surgical outcomes (Takamiya et al., 2023). Among young adults, cancer-related psychological distress is particularly severe,

with studies reporting distress prevalence rates exceeding 80% in adolescent and young adult (AYA) cancer populations (Duan et al., 2021). Fear of cancer recurrence, affecting 22–87% of cancer patients, represents a particularly distressing psychological burden that can persist long after treatment completion (Tao et al., 2025). Additionally, fertility concerns constitute a major source of anxiety for young female cancer patients, with many expressing worry about treatment-related fertility impairment and future family planning (Korenblum et al., 2025).

Traditional psychological interventions in perioperative care have predominantly focused on symptom reduction through education, cognitive-behavioral techniques, and anxiolytic pharmacotherapy. However, these approaches often adopt a deficit-based perspective, addressing pathology without cultivating patients' inherent psychological resources and resilience (Zhao et al., 2021). In contrast, positive psychology emphasizes the identification and enhancement of personal strengths, positive emotions, and meaningful engagement as pathways to well-being. The PERMA model, proposed by Seligman in 2011, provides a comprehensive theoretical framework encompassing five essential elements of flourishing: Positive emotion, Engagement, Relationships, Meaning, and Accomplishment (Kern et al., 2015).

Emerging evidence supports the efficacy of PERMA-based interventions in oncological populations. Recent studies have demonstrated that PERMA model interventions significantly reduce anxiety and depression while improving quality of life among breast cancer patients (Fang et al., 2023; D. Wang et al., 2024). Similarly, research in lung cancer chemotherapy patients has shown that PERMA-based psychological interventions effectively alleviate negative emotions, reduce cancer-related fatigue, and enhance hope levels (Tu et al., 2021). These promising findings suggest that PERMA-based approaches may be particularly well-suited for addressing the multifaceted psychological needs of cancer patients, including quality of life enhancement and fear of cancer recurrence reduction (Luo et al., 2025).

Despite growing interest in positive psychological interventions, research specifically examining PERMA-based approaches for preoperative anxiety management in young female lung cancer patients undergoing day surgery remains limited. This population faces unique developmental challenges, including career establishment, family planning, and identity formation, which may be disrupted by cancer diagnosis and treatment. Furthermore, the rapid discharge characteristic of day surgery models necessitates highly effective, time-efficient psychological interventions that can be seamlessly integrated into compressed perioperative pathways.

Therefore, this randomized controlled trial was designed to investigate the effectiveness of a PERMA model-based positive psychological intervention in reducing preoperative anxiety and improving psychological outcomes among young female lung cancer patients undergoing day surgery. We hypothesized that patients receiving the PERMA-based intervention would demonstrate significantly lower

anxiety, depression, stigma, and fear of cancer recurrence levels, as well as reduced fertility concerns, while showing enhanced quality of life, subjective well-being, social integration, health education acceptance, improved ERAS protocol adherence, and greater satisfaction compared to those receiving routine care alone.

Methods

Study Design and Setting

This prospective, single-blind, two-arm randomized controlled trial was conducted at our hospital, a tertiary referral center in Hangzhou, China. The study was approved by the hospital's Institutional Review Board. All participants provided written informed consent prior to enrollment. The trial adhered to the Consolidated Standards of Reporting Trials (CONSORT) guidelines for randomized controlled trials.

Participants

Inclusion Criteria

Eligible participants were required to meet all of the following criteria: (1) female patients aged 18–40 years; (2) confirmed diagnosis of primary lung cancer based on imaging findings (computed tomography or positron emission tomography-computed tomography) and scheduled for elective thoracoscopic day surgery with anticipated discharge within 48 hours; (3) clinical stage I disease; (4) Eastern Cooperative Oncology Group (ECOG) performance status of 0–1; (5) adequate organ function as determined by routine preoperative laboratory assessments; (6) ability to understand and complete questionnaires in Chinese; and (7) willingness to participate in the full study protocol and provide informed consent.

Exclusion Criteria

Patients were excluded if they met any of the following criteria: (1) pre-existing psychiatric disorders requiring ongoing pharmacological treatment, including major depressive disorder, generalized anxiety disorder, bipolar disorder, or schizophrenia; (2) cognitive impairment or severe communication barriers that would preclude participation in psychological intervention or completion of study questionnaires; (3) concurrent diagnosis of another malignancy or history of malignancy within the previous 5 years (except adequately treated basal cell or squamous cell skin cancer); (4) contraindications to general anesthesia or thoracoscopic surgery; (5) conversion to open thoracotomy anticipated preoperatively; (6) participation in another clinical trial within 3 months of enrollment; or (7) pregnancy or breastfeeding.

Withdrawal Criteria

Participants were withdrawn from the study if any of the following occurred: (1) withdrawal of informed consent at any time; (2) development of serious adverse events or medical complications requiring intensive care or transfer to another facility; (3) protocol violation or non-compliance with >50% of intervention sessions; (4) conversion from thoracoscopic to open surgery intraoperatively; (5) discovery of ineligibility after randomization (e.g., misdiagnosis, previously unrecognized psychiatric disorder); (6) loss to follow-up despite multiple contact attempts; or (7) investigator's judgment that continued participation was not in the participant's best interest.

Randomization and Blinding

Participants were randomly allocated to either the intervention group or the control group in a 1:1 ratio using computer-generated random numbers. Randomization was stratified by age (18–30 years vs. 31–40 years) and parity (nulliparous vs. parous) to ensure balanced distribution of these potentially confounding variables. The randomization sequence was generated by an independent statistician not involved in patient recruitment or outcome assessment. Group allocations were concealed in sequentially numbered, opaque, sealed envelopes opened only after baseline assessment and consent confirmation. Due to the nature of the psychological intervention, participants and intervention providers could not be blinded to group assignment. However, outcome assessors and data analysts remained blinded to group allocation throughout the study period.

Interventions

Control Group

Participants allocated to the control group received standard perioperative nursing care according to the hospital's established protocols for thoracic surgery patients. This included routine pre-admission assessments, standardized patient education regarding surgical procedures and postoperative care, ERAS protocol implementation, and regular nursing support throughout the hospitalization period. Educational materials provided to control group patients covered topics such as surgical procedure overview, anesthesia information, postoperative pain management, respiratory exercises, early mobilization, and discharge criteria.

Intervention Group

In addition to standard care, intervention group participants received a structured PERMA model-based positive psychological intervention developed specifically for this study. The intervention was delivered by trained nurse coordinators who had completed a 40-hour training program covering positive

psychology principles, PERMA model components, motivational interviewing techniques, and specific intervention protocols. The intervention protocol comprised the following five core components aligned with the PERMA framework:

(1) Positive Emotion Cultivation. This component aimed to enhance patients' awareness and experience of positive emotions through three primary techniques. First, guided gratitude exercises encouraged patients to identify and record three specific aspects of their daily experience for which they felt grateful, with particular emphasis on personal strengths, supportive relationships, and meaningful experiences. Second, positive emotion regulation training utilized evidence-based techniques including mindful breathing exercises, progressive muscle relaxation, and guided imagery focused on calming, pleasant scenarios. These exercises were practiced daily for 15–20 minutes. Third, patients were introduced to savoring strategies, learning to fully engage with and extend positive experiences through focused attention, sharing with others, and memory building. Patients received a workbook with guided exercises and were encouraged to maintain a daily gratitude journal.

(2) Engagement Enhancement. To promote active engagement with health behaviors and treatment protocols, patients participated in structured goal-setting activities. Each patient worked collaboratively with the nurse coordinator to establish personalized, achievable preoperative and postoperative goals. These typically included respiratory function optimization goals (e.g., incentive spirometry targets), physical activity objectives (e.g., daily step counts, early ambulation milestones), and self-care competencies (e.g., wound care, pain management). Goals were documented using SMART (Specific, Measurable, Achievable, Relevant, Time-bound) criteria. Additionally, patients were taught engagement-promoting breathing techniques and participated in preoperative pulmonary rehabilitation exercises. Progress toward goals was monitored through daily check-ins, and achievements were explicitly acknowledged and celebrated to reinforce engagement and self-efficacy.

(3) Relationship Strengthening. Recognizing the critical importance of social support, this component focused on enhancing and mobilizing patients' support networks. Family members were actively invited to participate in educational sessions held twice during the pre-admission period (approximately 7-10 days and 2-3 days before surgery, each lasting 45 minutes) and once on the admission day (30 minutes). During these sessions, they were provided with guidance on effective emotional support strategies, including active listening, validation of emotions, and practical assistance. Patients were encouraged to communicate openly with family and friends about their needs and concerns. For patients with limited immediate support networks, connections were facilitated to peer support resources, including other young female lung cancer patients who had successfully completed treatment. The intervention also included specific training for family members in supporting ERAS protocol adherence, particularly in

facilitating early mobilization and respiratory exercises. Communication skills training emphasized constructive ways to express needs and accept support.

(4) Meaning Finding. This component utilized cognitive reframing and narrative approaches delivered through three one-on-one structured interviews (initial session during pre-admission period lasting 40 minutes, follow-up session 2–3 days before surgery lasting 30 minutes, and final session on admission day lasting 20 minutes) to help patients construct meaning from their cancer experience. Through structured discussions with the nurse coordinator, patients were guided to identify potential sources of meaning within their cancer journey, such as opportunities for personal growth, deepened relationships, clarified life priorities, or contribution to medical knowledge. Patients were encouraged to reflect on their core values and explore how their values could guide decision-making and behavior throughout treatment and recovery. Existential concerns, such as mortality awareness and life purpose, were addressed compassionately through supportive exploration. For patients expressing spiritual or religious orientations, connections to appropriate resources (chaplaincy services, meditation groups) were facilitated. Patients were provided with prompts for journaling about meaningful experiences and personal growth.

(5) Accomplishment Recognition. To foster a sense of competence and achievement, this component emphasized recognition and celebration of patients' accomplishments throughout the perioperative period. Small victories were systematically acknowledged, including successful completion of preoperative assessments, mastery of respiratory exercises, achievement of ambulation goals, and meeting discharge criteria. Patients were taught to reframe challenges as opportunities for developing mastery and resilience. A structured reward system was implemented wherein patients received tangible acknowledgment (certificates, stickers in an achievement log) for milestone accomplishments. Verbal praise and positive feedback were provided liberally by the nursing staff. Patients were encouraged to recognize their own strengths and capabilities, particularly in successfully navigating the demands of day surgery. At discharge, patients received a personalized summary letter highlighting their specific achievements and strengths demonstrated throughout their surgical experience.

The intervention was delivered across three phases. The pre-admission phase (7–14 days before surgery) included an initial 60-minute individual session introducing the PERMA model and initiating positive emotion and meaning-finding work, followed by daily 10–15 minute telephone or video consultations reinforcing goals and emotional regulation strategies. The admission phase included a 30-minute bedside session reviewing coping plans and mobilizing family support, while the postoperative phase included two brief reinforcement contacts before discharge. Intervention fidelity was prospectively monitored using a 22-item session checklist linked to the five PERMA domains. Nurse coordinators completed the checklist after every contact, and a senior psycho-oncology nurse independently audited 15% of

audio-recorded sessions selected by random number table. Prespecified adequate fidelity was defined as completion of > = 85% of mandatory elements. Mean protocol adherence across audited sessions was 93.6%, inter-rater agreement for fidelity scoring was 0.91, and no material contamination between groups was identified.

Outcome Measures

Primary Outcome

The primary outcome was preoperative anxiety measured using the Self-Rating Anxiety Scale (SAS), a widely validated 20-item instrument assessing the frequency of anxiety-related symptoms. Each item is rated on a 4-point scale (1 = none or little of the time, 2 = some of the time, 3 = a good part of the time, 4 = most or all of the time). Raw scores are converted to standardized scores (range: 20–80), with higher scores indicating greater anxiety severity. Scores of 50 or above indicate clinically significant anxiety, with 50–59 indicating mild anxiety, 60–69 moderate anxiety, and ≥70 severe anxiety. The Chinese version of the SAS has demonstrated excellent psychometric properties in cancer populations (Cronbach's $\alpha = 0.89$, test-retest reliability = 0.77). The SAS was administered at two time points: (1) baseline assessment conducted 10–14 days before scheduled surgery during the pre-admission clinic visit, and (2) preoperative assessment on the morning of surgery, 2–3 hours before the scheduled procedure, ensuring a minimum 7-day interval between assessments to align with the instrument's 7-day recall period for symptom evaluation.

Secondary Outcomes

Depression. Depressive symptoms were assessed using the Self-Rating Depression Scale (SDS), a 20-item self-report questionnaire parallel in structure to the SAS. Items assess cognitive, affective, and somatic symptoms of depression, each rated on a 4-point frequency scale. Raw scores are converted to standardized scores (range: 25–100), with scores ≥53 indicating clinically significant depression. The Chinese version has demonstrated strong psychometric properties (Cronbach's $\alpha = 0.91$). The SDS was administered at baseline and preoperatively.

Cancer-Related Stigma. Stigma was measured using a lung cancer-specific stigma scale assessing internalized shame, perceived social rejection, and self-blame. The scale comprises 15 items rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), with total scores ranging from 15 to 75. Higher scores indicate greater stigma. This measure has demonstrated adequate reliability in Chinese lung cancer populations (Cronbach's $\alpha = 0.86$). Stigma was assessed at baseline (10–14 days before surgery) and postoperatively (within 2 hours before discharge, typically 24–36 hours after surgery).

Fear of Cancer Recurrence. Fear of cancer recurrence was evaluated using the Fear of Cancer Recurrence Inventory-Short Form (FCRI-SF), a validated 9-item questionnaire assessing the severity of FCR. Items are rated on a 5-point Likert scale (0 = not at all to 4 = a great deal), with total scores ranging from 0 to 36. Higher scores indicate greater fear of recurrence. A cutoff score of ≥13 indicates clinically significant FCR. The Chinese version has demonstrated excellent reliability (Cronbach's $\alpha = 0.88$) and validity in cancer populations. The FCRI-SF was administered at baseline and postoperatively.

Fertility Concerns. Given the unique concerns of young female cancer patients, fertility-related worries were assessed using the Reproductive Concerns After Cancer (RCAC) scale. This 18-item measure evaluates fertility concerns, partner disclosure worries, and child's health concerns on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), with total scores ranging from 18 to 90. Higher scores reflect greater fertility-related distress. The Chinese-validated version has shown good internal consistency (Cronbach's $\alpha = 0.87$). The RCAC was administered at baseline and postoperatively.

Quality of Life. Quality of life was measured using the Functional Assessment of Cancer Therapy-Lung (FACT-L), a comprehensive 36-item instrument assessing physical, social/family, emotional, and functional well-being, as well as lung cancer-specific concerns. Items are rated on a 5-point scale (0 = not at all to 4 = very much), with total scores ranging from 0 to 136. Higher scores indicate better quality of life. The Chinese version of FACT-L has demonstrated excellent psychometric properties (Cronbach's $\alpha = 0.92$). Quality of life was assessed at baseline and at discharge.

Subjective Well-being. Subjective well-being was evaluated using a single-item measure asking patients to rate their overall life satisfaction on a 5-point Likert scale (1 = very dissatisfied to 5 = very satisfied). This brief measure has shown acceptable validity as a global indicator of well-being in cancer populations. Assessment occurred at baseline and at discharge.

Social Integration. Social integration was measured using the Social Adaptation Self-evaluation Scale (SASS), a 21-item questionnaire assessing social functioning across work, family, and leisure domains. Items are rated on a 4-point scale (0 = never to 3 = always), with total scores ranging from 0 to 60. Scores ≥35 indicate normal social functioning, while scores <35 suggest impaired social integration. The Chinese version has demonstrated good reliability (Cronbach's $\alpha = 0.84$). The SASS was administered at baseline and at discharge.

Health Education Acceptance. Patient comprehension and acceptance of health education was evaluated using a study-specific questionnaire assessing understanding of surgical procedures, postoperative care requirements, ERAS protocols, potential complications, and discharge criteria. The questionnaire consisted of 20 true/false and multiple-choice items, with scores expressed as

percentage correct. A score of ≥80% was considered satisfactory health education acceptance. Assessment occurred post-education, typically 1–2 days prior to surgery.

ERAS Protocol Execution. Adherence to ERAS protocols was documented using a structured checklist covering key elements including early oral intake (within 4 hours postoperatively), early mobilization (out of bed within 6 hours), respiratory exercises (incentive spirometry targets), pain management participation, and timely drain removal. Each element was coded as compliant or non-compliant. An overall execution rate was calculated as the percentage of ERAS elements successfully completed by discharge. Documentation was performed by blinded nursing staff using standardized criteria.

Patient Satisfaction. Satisfaction with care was measured using a 5-point Likert scale (1 = very dissatisfied to 5 = very satisfied) addressing overall care quality, nursing support, information provision, pain management, and emotional support. Mean satisfaction scores across all domains were calculated. Assessment occurred at discharge.

Perioperative Outcomes. Additional clinical outcomes monitored included length of hospital stay (hours from admission to discharge), postoperative complications (pneumothorax, atelectasis, pneumonia, arrhythmia), pain scores (visual analog scale, 0–10), and 15-day readmission rates. These data were extracted from electronic medical records by research staff blinded to group allocation.

Statistical Analysis

Sample size calculation was based on the primary outcome of preoperative anxiety (SAS score). Assuming a clinically meaningful difference of 8 points in SAS scores between groups, a standard deviation of 12 (Zhang, 1998), alpha = 0.05 (two-tailed), and power of 80%, a minimum of 57 participants per group was required. Accounting for an anticipated 20% attrition rate, the target enrollment was 144 participants (72 per group). All analyses followed the intention-to-treat principle. Baseline characteristics were compared using independent t-tests for continuous variables and chi-square or Fisher's exact tests for categorical variables. For primary and secondary outcomes, between-group differences in continuous measures were analyzed using independent t-tests or Mann-Whitney U tests for non-normally distributed data. Normality of distribution was assessed using the Shapiro-Wilk test for sample sizes <50 or the Kolmogorov-Smirnov test for sample sizes > = 50. Analysis of covariance was performed to adjust for baseline values when appropriate. Categorical outcomes were compared using chi-square tests. Changes from baseline to post-intervention were analyzed using paired t-tests within groups. The primary endpoint was tested at a two-tailed significance threshold of p <0.05. Because multiple secondary outcomes were examined, adjusted p values were additionally derived with the Holm-Bonferroni procedure; results retaining adjusted significance were interpreted as robust, whereas outcomes not surviving adjustment

were interpreted as exploratory. Between-group effect sizes were expressed as Cohen's d using pooled post-intervention standard deviations, with 95% confidence intervals reported for absolute mean differences. All analyses were conducted using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Missing data were handled using multiple imputation with 20 imputed datasets. Sensitivity analyses were performed using complete-case analysis to assess the robustness of findings.

Ethical Considerations

All procedures were conducted in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments. Participants were fully informed about the study objectives, procedures, potential risks and benefits, and their right to withdraw at any time without affecting their medical care. Written informed consent was obtained from all participants prior to any study procedures. Confidentiality was maintained through de-identification of data and secure storage of records. The study posed minimal risk to participants, as the psychological intervention employed evidence-based techniques and was delivered by trained healthcare professionals. Participants experiencing significant psychological distress were referred to appropriate mental health services. All data were stored securely and accessed only by authorized research personnel.

Results

Participant Flow and Baseline Characteristics

Between March 2025 and June 2025, 156 patients were assessed for eligibility. Of these, 12 were excluded (8 did not meet inclusion criteria, 4 declined to participate), resulting in 144 patients who were randomized to either the intervention group (n = 73) or control group (n = 71). All randomized participants completed the study protocol with no dropouts or protocol violations, yielding a 100% retention rate. Complete outcome data were obtained for all participants.

Baseline demographic and clinical characteristics were well-balanced between groups, indicating successful randomization (Table 1). The mean age was 33.3±4.5 years in the intervention group and 33.8±4.8 years in the control group (p = 0.52). The majority of participants in both groups were married (76.7% vs. 78.9%, p = 0.74), had completed higher education (67.1% vs. 73.2%, p = 0.41), and had given birth (74.0% vs. 70.4%, p = 0.62). Surgical characteristics were also comparable, with similar distributions of surgical procedures (p = 0.35) and mean operative times (1.54±0.51 hours vs. 1.11±0.28 hours, p = 0.47). Pathological diagnoses were predominantly adenocarcinoma variants (microinvasive and invasive adenocarcinoma), with similar distributions across groups.

Table 1. Baseline Characteristics of Study Participants

Characteristic	Intervention (n = 73)	Control (n = 71)	P value
Age (years), mean ± SD	33.3 ± 4.5	33.8 ± 4.8	0.52
Marital status, n (%)			0.74
Married	56 (76.7)	56 (78.9)	
Single	14 (19.2)	13 (18.3)	
Divorced	3 (4.1)	2 (2.8)	
Educational level, n (%)			0.41
College or above	49 (67.1)	52 (73.2)	
High school	13 (17.8)	8 (11.3)	
Middle school or below	11 (15.1)	11 (15.5)	
Parity (parous), n (%)	54 (74.0)	50 (70.4)	0.62
Pathological diagnosis, n (%)			0.68
Microinvasive adenocarcinoma	28 (38.4)	25 (35.2)	
Invasive adenocarcinoma	41 (56.2)	42 (59.2)	
Other	4 (5.4)	4 (5.6)	
Surgical procedure, n (%)			0.35
Wedge resection	35 (47.9)	38 (53.5)	
Segmentectomy	28 (38.4)	22 (31.0)	
Lobectomy	10 (13.7)	11 (15.5)	
Surgery duration (hours), mean ± SD	1.54 ± 0.51	1.11 ± 0.28	0.47

Primary Outcome: Preoperative Anxiety

At baseline, anxiety levels were comparable between groups, with mean SAS scores of 54.2±8.6 in the intervention group and 53.9±8.9 in the control group (p = 0.83), indicating moderate anxiety in both groups (Table 2). Following the intervention, the intervention group demonstrated a significant reduction in anxiety scores to 42.3±6.8, representing a mean decrease of 11.9 points from baseline (p <0.001). In contrast, the control group showed minimal change, with preoperative SAS scores of 51.7±8.2 (mean reduction of 2.2 points, p = 0.06).

Table 2. Primary and Secondary Psychological Outcomes

Outcome	Time point	Intervention	Control	Between-group p value	Cohen's d
Anxiety (SAS)	Baseline	54.2 ± 8.6	53.9 ± 8.9	0.83	
	Post-intervention	42.3 ± 6.8	51.7 ± 8.2	<0.001	1.25

Outcome	Time point	Intervention	Control	Between-group *p* value	Cohen's d
Depression (SDS)	Baseline	48.9 ± 9.4	49.3 ± 9.7	0.80	
	Post-intervention	38.6 ± 7.2	47.3 ± 9.1	<0.001	1.06
Stigma score	Baseline	42.6 ± 11.3	43.1 ± 11.8	0.80	
	Post-intervention	34.2 ± 9.6	41.8 ± 10.9	<0.001	0.74
FCR (FCRI-SF)	Baseline	19.7 ± 6.4	19.2 ± 6.7	0.67	
	Post-intervention	18.3 ± 5.2	24.6 ± 6.8	<0.001	1.04
Fertility concerns (RCAC)	Baseline	45.8 ± 12.6	46.2 ± 13.1	0.86	
	Post-intervention	38.2 ± 10.4	43.7 ± 11.8	0.003	0.49
Quality of Life (FACT-L)	Baseline	68.4 ± 10.8	67.9 ± 11.2	0.79	
	Discharge	76.8 ± 9.3	65.2 ± 11.4	<0.001	1.12
Subjective Well-being	Baseline	3.1 ± 0.7	3.0 ± 0.8	0.45	
	Discharge	4.2 ± 0.6	3.3 ± 0.8	<0.001	1.28
Social Integration (SASS)	Baseline	38.6 ± 11.4	37.9 ± 11.8	0.73	
	Discharge	42.4 ± 10.2	36.8 ± 12.8	0.002	0.48

Note: Data are presented as mean ± standard deviation. For each outcome, the baseline row compares the intervention and control groups at baseline, and the post-intervention/discharge row compares the intervention and control groups at the corresponding post-intervention time point. Cohen's d refers to the between-group standardized effect size at post-intervention/discharge; therefore, p <0.001 in Table 2 refers to the post-intervention/discharge comparison between the intervention and control groups for the corresponding outcome.
FCR = Fear of Cancer Recurrence; FCRI-SF = Fear of Cancer Recurrence Inventory-Short Form; RCAC = Reproductive Concerns After Cancer; FACT-L = Functional Assessment of Cancer Therapy-Lung; SASS = Social Adaptation Self-evaluation Scale.

The between-group difference in post-intervention anxiety scores was statistically and clinically significant, with the intervention group exhibiting 9.4 points lower anxiety on average (95% CI -11.9 to -6.9; Cohen's d = 1.25; p <0.001). Given that a 5-point shift on the SAS is commonly considered clinically perceptible in perioperative settings, the observed between-group difference indicates not only statistical superiority but also a change likely to be meaningful for patient experience and perioperative cooperation. Notably, the proportion of participants with clinically significant anxiety (SAS > = 50) decreased from 71.2% to 28.8% in the intervention group, compared with a reduction from 69.0% to 56.3% in the control group (p <0.001 for between-group comparison, Figure 1).

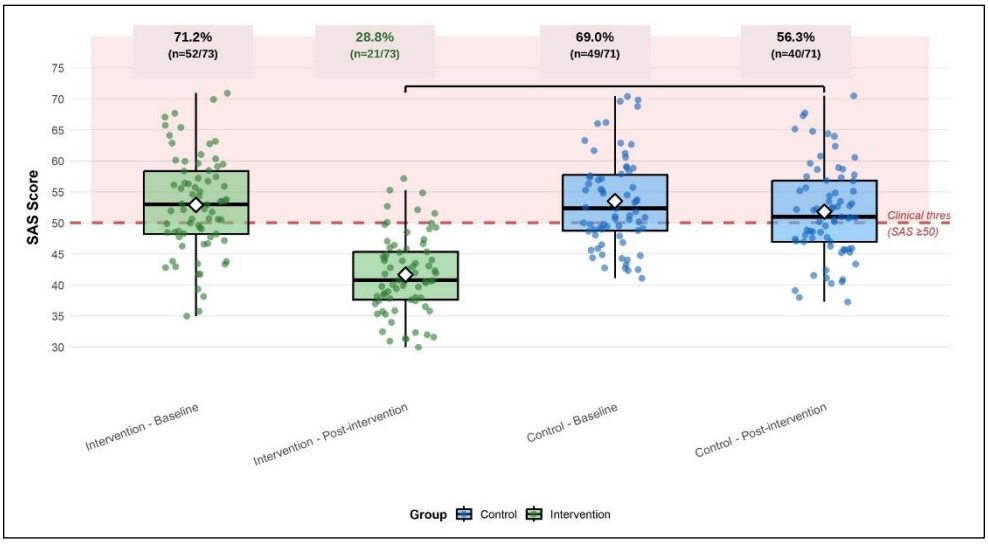


Figure 1. Proportion of Participants with Clinically Significant Anxiety (SAS ≥50)

*, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$. ns, not significant.

Secondary Outcomes

Depression, Stigma, and Fear of Cancer Recurrence

Consistent with the primary outcome, depression scores showed significant improvement in the intervention group. Baseline SDS scores were similar between groups (intervention 48.9±9.4 vs. control 49.3±9.7, $p = 0.80$), both in the subclinical range but approaching the threshold for clinical depression. Post-intervention, the intervention group demonstrated a marked reduction in depressive symptoms (38.6±7.2), whereas the control group showed minimal change (47.3±9.1), resulting in a significant between-group difference of 8.7 points (95% CI -11.4 to -6.0; Cohen's $d = 1.06$; $p < 0.001$) (Table 2). Similarly, cancer-related stigma decreased significantly more in the intervention group (from 42.6±11.3 to 34.2±9.6) than in the control group (from 43.1±11.8 to 41.8±10.9), with a between-group difference of 7.6 points (95% CI -11.0 to -4.2; $d = 0.74$; $p < 0.001$). The intervention was particularly effective in reducing internalized shame and self-blame components of stigma. Both outcomes remained significant after Holm-Bonferroni correction.

Fear of cancer recurrence showed a notable pattern. At baseline, both groups exhibited moderate FCR levels (intervention 19.7±6.4 vs. control 19.2±6.7, $p = 0.67$), with approximately 58% of participants scoring above the clinical threshold (FCRI-SF > = 13). Following the intervention, the intervention group showed a modest but statistically significant reduction in FCR (18.3±5.2), whereas

the control group demonstrated increased FCR scores (24.6±6.8), likely reflecting heightened anxiety as surgery approached. The between-group difference was substantial (6.3 points, 95% CI -8.3 to -4.3; Cohen's $d = 1.04$; $p < 0.001$), and this finding also remained significant after multiplicity adjustment. The proportion of participants with clinically significant FCR decreased from 58.9% to 47.9% in the intervention group, while increasing from 57.7% to 73.2% in the control group ($p < 0.001$).

Fertility Concerns and Reproductive Worries

Fertility concerns, as measured by the RCAC scale, were prevalent at baseline with no significant difference between groups (intervention 45.8±12.6 vs. control 46.2±13.1, $p = 0.86$). Post-intervention assessment revealed that the intervention group experienced a significant reduction in fertility-related distress (38.2±10.4), representing an improvement of 7.6 points from baseline. In contrast, the control group showed minimal change (43.7±11.8). The between-group difference was statistically significant (5.5 points, 95% CI -9.1 to -1.9; Cohen's $d = 0.49$; $p = 0.003$), and retained significance after Holm-Bonferroni adjustment. Subscale analysis indicated that the intervention was particularly effective in reducing worries about future fertility potential ($p < 0.001$) and concerns about partner disclosure ($p = 0.003$), though concerns about potential health effects on future children showed more modest improvement ($p = 0.04$). Among nulliparous participants ($n = 39$), the magnitude of fertility concern reduction was even more pronounced in the intervention group (mean reduction 9.8 points vs. 1.2 points in controls, $p < 0.001$).

Quality of Life and Subjective Well-being

Quality of life, assessed using the FACT-L, showed significant improvement in the intervention group. Baseline quality-of-life scores were comparable between groups (intervention 68.4±10.8 vs. control 67.9±11.2, $p = 0.79$), indicating moderate impairment consistent with recent cancer diagnosis. At discharge, the intervention group demonstrated substantially higher quality-of-life scores (76.8±9.3) compared with the control group (65.2±11.4), yielding a between-group difference of 11.6 points (95% CI 8.2 to 15.0; Cohen's $d = 1.12$; $p < 0.001$). This magnitude exceeds commonly cited minimally important differences for FACT-family instruments and therefore supports clear clinical benefit in addition to statistical significance. Domain-specific analysis revealed that the intervention particularly benefited emotional well-being ($p < 0.001$), functional well-being ($p < 0.001$), and lung cancer-specific concerns ($p = 0.002$), with more modest effects on physical well-being ($p = 0.03$) and social/family well-being ($p = 0.08$). The global quality-of-life result remained significant after Holm-Bonferroni correction.

Subjective well-being, measured on a 5-point scale, demonstrated consistent improvement patterns. Baseline ratings were low in both groups (intervention 3.1±0.7 vs. control 3.0±0.8, $p = 0.45$), reflecting the psychological burden of recent cancer diagnosis. At discharge, the intervention group reported significantly higher subjective well-being (4.2±0.6) compared with controls (3.3±0.8), with a mean difference of 0.9 points (95% CI 0.67 to 1.13; Cohen's $d = 1.28$; $p < 0.001$). The proportion of participants rating their well-being as satisfied or very satisfied increased from 23.3% to 79.5% in the intervention group, compared with 21.1% to 38.0% in the control group ($p < 0.001$). This endpoint also remained significant after multiplicity adjustment.

Social Integration

Social integration, assessed using the SASS, showed notable between-group differences. At baseline, both groups exhibited suboptimal social functioning (intervention 38.6±11.4 vs. control 37.9±11.8, $p = 0.73$), with approximately 35% of participants scoring below the threshold for normal social functioning (<35 points). At discharge, the intervention group demonstrated improved social integration (42.4±10.2), while the control group showed deterioration (36.8±12.8), resulting in a between-group difference of 5.6 points (95% CI 1.8 to 9.4; Cohen's $d = 0.48$; $p = 0.002$). The intervention group showed particular improvements in work-related functioning ($p = 0.001$) and leisure activities ($p = 0.004$), with more modest improvements in family relationships ($p = 0.08$). The proportion of participants with impaired social functioning decreased from 34.2% to 20.5% in the intervention group, while increasing from 35.2% to 47.9% in the control group ($p = 0.001$). The overall SASS result remained significant after Holm-Bonferroni correction.

Health Education and ERAS Protocol Adherence

Health education acceptance rates were significantly higher in the intervention group (94.5%, $n = 69$) than in the control group (78.9%, $n = 56$) (chi-square = 7.94, $p = 0.005$). Intervention group participants demonstrated superior comprehension of surgical procedures, postoperative care requirements, and expected recovery trajectories. This enhanced understanding translated into markedly improved ERAS protocol execution rates. The intervention group achieved a mean ERAS adherence rate of 91.8±8.3%, compared with 76.1±14.6% in the control group (mean difference 15.7, 95% CI 11.8 to 19.6; Cohen's $d = 1.33$; $p < 0.001$) (Figure 2). Component analysis revealed that the intervention group showed significantly better compliance with early mobilization (95.9% vs. 73.2%, $p < 0.001$), respiratory exercises (93.2% vs. 69.0%, $p < 0.001$), and pain management protocols (97.3% vs. 84.5%, $p = 0.006$). Early oral intake adherence was uniformly high in both groups (98.6% vs. 94.4%, $p = 0.15$). After Holm-Bonferroni correction,

ERAS adherence remained significant, whereas the health education acceptance comparison should be interpreted as nominal.

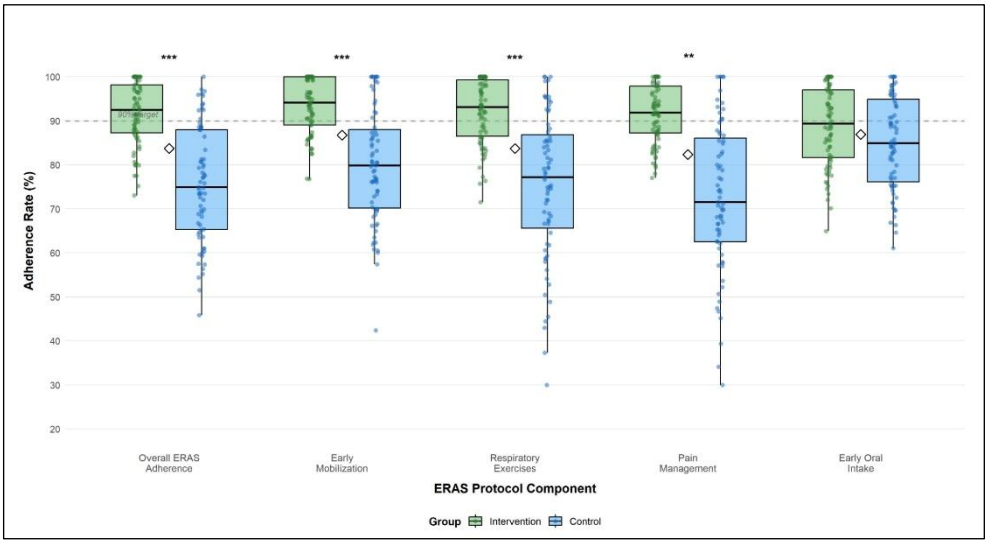


Figure 2. Enhanced Recovery After Surgery (ERAS) Protocol Execution Rates

*, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$. ns, not significant.

Patient Satisfaction and Clinical Outcomes

Overall satisfaction scores were significantly higher in the intervention group (4.6±0.5) compared with the control group (3.8±0.7) (mean difference 0.8, 95% CI 0.60 to 1.00; Cohen's $d = 1.32$; $p < 0.001$). Domain-specific satisfaction was notably higher for emotional support (4.7±0.5 vs. 3.4±0.8, $p < 0.001$) and information provision (4.8±0.4 vs. 4.0±0.7, $p < 0.001$). Clinical outcomes demonstrated favorable trends in the intervention group, including shorter mean length of stay (26.3±6.2 hours vs. 30.7±8.4 hours, $p < 0.001$) and lower postoperative pain scores at 24 hours (2.8±1.3 vs. 3.6±1.6, $p = 0.002$). Postoperative complication rates were low and comparable between groups (5.5% vs. 8.5%, $p = 0.46$), with no major adverse events. The 15-day readmission rate was 1.4% in the intervention group and 2.8% in the control group ($p = 0.56$). The satisfaction endpoint remained significant after Holm-Bonferroni correction (Table 3).

Table 3. Patient Satisfaction and Clinical Outcomes

Outcome	**Intervention (*n* = 73)**	**Control (*n* = 71)**	**P value**
Overall patient satisfaction score	4.6 ± 0.5	3.8 ± 0.7	<0.001
Emotional support satisfaction	4.7 ± 0.5	3.4 ± 0.8	<0.001

Outcome	Intervention (n = 73)	Control (n = 71)	P value
Information provision satisfaction	4.8 ± 0.4	4.0 ± 0.7	<0.001
Length of hospital stay, h	26.3 ± 6.2	30.7 ± 8.4	<0.001
Postoperative pain score (24 h)	2.8 ± 1.3	3.6 ± 1.6	0.002
Postoperative complications, %	5.5	8.5	0.46
15-day readmission rate, %	1.4	2.8	0.56

Discussion

This randomized controlled trial provides robust evidence that a PERMA model-based positive psychological intervention effectively reduces preoperative anxiety and improves multiple psychological and behavioral outcomes in young female lung cancer patients undergoing day surgery. The intervention demonstrated clinically meaningful reductions in anxiety, depression, stigma, and fear of cancer recurrence, as well as reduced fertility concerns. Additionally, participants in the intervention group showed significantly enhanced quality of life, subjective well-being, and social integration, along with improved health education acceptance, ERAS protocol adherence, and patient satisfaction. The magnitude of the primary effect was large (Cohen's d = 1.25), and several secondary endpoints also showed moderate-to-large standardized effects, supporting that the intervention was not only statistically effective but also practically important for perioperative care.

The observed reduction in preoperative anxiety represents a substantial and clinically significant improvement. The 9.4-point difference in SAS scores between groups exceeded the threshold generally considered meaningful for perioperative symptom change, and the absolute reduction in the prevalence of clinically significant anxiety was 27.5 percentage points. Expressed differently, approximately one additional case of clinically significant anxiety was prevented for every four patients receiving the intervention. This magnitude of effect compares favorably with prior psychological nursing and positive-psychology-based interventions in thoracic or oncological settings (Y. Huang et al., 2026; X. Wang et al., 2025). The finding that preoperative state anxiety predicts postoperative quality of life (Takamiya et al., 2023) further underscores the potential downstream value of timely anxiety reduction.

The comprehensive nature of the PERMA-based intervention likely contributed to its effectiveness by addressing multiple dimensions of psychological well-being simultaneously. By cultivating positive emotions through gratitude practices and emotion regulation techniques, the intervention provided participants with concrete skills for managing anxiety-provoking thoughts and situations. The engagement component fostered active participation in recovery-promoting behaviors, transforming patients from passive recipients of care to empowered agents in their own healing process. This shift in mindset may explain the superior

ERAS protocol adherence observed in the intervention group (Batchelor et al., 2019). Strengthening social relationships through family involvement and peer connections likely buffered the isolating effects of cancer diagnosis and treatment, consistent with literature demonstrating the protective effects of social support on psychological distress and cancer adjustment (Pinquart & Duberstein, 2010).

The meaning-finding component of the PERMA intervention warrants particular attention in the context of young adult cancer patients. Young women diagnosed with lung cancer confront profound existential challenges as they navigate cancer during a developmental period typically characterized by life expansion rather than confrontation with mortality. By facilitating meaning-making and value clarification, the intervention may have helped participants integrate their cancer experience into a coherent life narrative, thereby reducing psychological distress (Sansom-Daly & Wakefield, 2013). This interpretation is also compatible with post-traumatic growth theory, which posits that cognitive processing and meaning reconstruction after trauma can foster better psychological adaptation (Tedeschi & Calhoun, 2004). The reduced stigma observed in the intervention group further suggests that the intervention successfully addressed internalized shame and self-blame, potentially through the normalizing effects of peer support and the reframing of cancer as a life event rather than a personal failure (Kim & Yi, 2014).

The significant reduction in fear of cancer recurrence in the intervention group represents an important finding. The intervention group demonstrated a modest but meaningful reduction in FCR scores (from 19.7±6.4 to 18.3±5.2, representing a 7.1% decrease), whereas the control group exhibited markedly increased FCR as surgery approached (from 19.2±6.7 to 24.6±6.8, representing a 28.1% increase), a pattern consistent with heightened presurgical uncertainty in the absence of effective psychological support. This suggests that the PERMA-based intervention equipped patients with psychological resources to manage uncertainty and future-oriented worries. The relationship-strengthening component may have been particularly salient for FCR reduction, as social support has been identified as a protective factor against fear of progression and recurrence in thoracic oncology populations (Tao et al., 2025). Future research should examine whether these FCR reductions persist into survivorship and whether additional booster sessions might further consolidate gains.

The meaningful reduction in fertility concerns observed in the intervention group addresses a critical but often overlooked source of distress in young female cancer patients. Fertility preservation and family planning concerns are developmentally salient for women in this age range and can profoundly impact treatment decision-making, psychological adjustment, and long-term quality of life (Smrke et al., 2020). While thoracoscopic lung cancer surgery typically does not directly threaten fertility, the cancer diagnosis itself and concerns about treatment compatibility with pregnancy can generate substantial anxiety. The intervention's success in addressing these concerns likely stemmed from multiple components: the

relationship strengthening element facilitated discussion with partners and family members about reproductive concerns; the meaning-finding component helped patients contextualize fertility within broader life values; and the accomplishment recognition component emphasized patients' agency and hope for the future. These findings underscore the importance of incorporating fertility counseling and support into psychological interventions for young female cancer patients, even in cancer types not traditionally associated with fertility impairment.

The substantial improvements in quality of life and subjective well-being in the intervention group provide strong evidence for the intervention's impact on holistic patient outcomes. The 11.6-point improvement in FACT-L scores represents a clinically meaningful enhancement spanning multiple domains, and the large standardized effect indicates that improved perioperative coping translated into broader daily functioning. Notably, the intervention demonstrated particularly strong effects on emotional and functional well-being, suggesting that psychological preparation not only alleviated negative affect but also enhanced patients' capacity for meaningful engagement with daily activities and social roles. This finding aligns with the PERMA model's emphasis on flourishing rather than merely reducing pathology. The parallel improvement in subjective well-being reinforces the intervention's success in promoting overall life satisfaction despite the challenging circumstances of cancer diagnosis and surgery (Faller et al., 2013).

The improvement in social integration observed in the intervention group addresses a critical yet frequently neglected aspect of cancer care. Young women with cancer often experience disruption to their social roles and relationships, potentially leading to social isolation and diminished quality of life. The finding that the intervention group demonstrated improved social functioning while the control group showed deterioration is particularly striking and suggests that without proactive intervention, the perioperative period may further compromise social adaptation. The relationship strengthening component of the PERMA intervention explicitly targeted social support mobilization and communication skills, which likely contributed to these gains. Improved social integration has important implications beyond the immediate perioperative period, as strong social connections predict better long-term psychological adjustment and potentially improved survival in cancer populations (van der Velpen et al., 2024). The specific improvements in work-related functioning are particularly relevant for this population of young women who are typically in the midst of career establishment.

The superior health education acceptance and ERAS execution rates in the intervention group represent clinically important secondary benefits. Enhanced Recovery After Surgery protocols have transformed perioperative care by accelerating recovery, reducing complications, and shortening hospital stays (Batchelor et al., 2019; Dolan et al., 2024). However, successful ERAS implementation fundamentally depends on active patient participation in behaviors such as early mobilization, respiratory exercises, and pain-management strategies.

Traditional educational approaches often fail to address motivational and emotional barriers that impede adherence. By integrating engagement-enhancing strategies, accomplishment recognition, and anxiety reduction into the educational framework, the PERMA-based intervention created more favorable conditions for learning and behavior change. The 91.8% ERAS adherence rate achieved in the intervention group substantially exceeds adherence levels typically reported in thoracic ERAS studies (L. Huang et al., 2024), suggesting that psychological preparation may be as important as technical education in optimizing ERAS outcomes.

The feasibility of implementing PERMA-based interventions within compressed day-surgery pathways also deserves emphasis. Day-surgery models limit opportunities for extended face-to-face therapy, yet our phased approach initiated support during the pre-admission period, when anxiety is often increasing but medical contact remains limited (Forster et al., 2021; Young et al., 2023). The use of telephone and video consultations maintained continuity without imposing additional clinic visits. Importantly, the fidelity findings showed that the intervention could be delivered with high consistency after focused nurse training, with audited adherence of 93.6% and excellent inter-rater agreement. The positive impact on length of stay further suggests that the time invested in psychological preparation may generate downstream efficiency gains, improving the practical appeal of this model for day-surgery programs (Fuller et al., 2025).

Several aspects of the current study merit consideration when interpreting the findings. First, the study was conducted at a single tertiary care center with an established day-surgery program and experienced thoracic surgery team. Generalizability to community hospitals or centers with less developed ambulatory thoracic infrastructure warrants investigation. Second, the intervention was delivered by dedicated nurse coordinators who underwent specialized training. Implementation in settings without such personnel may require adaptation or additional investment in training. Third, the study focused specifically on young female patients with early-stage lung cancer undergoing elective day surgery. Whether similar benefits would be observed in male patients, older populations, or those with more advanced disease requires further study. Fourth, although perioperative outcomes were comprehensively assessed, longer follow-up is needed to determine whether early anxiety reduction translates into sustained quality-of-life gains, long-term social reintegration, or durable reduction in recurrence-related distress (Götze et al., 2019).

Future research should address several important questions. Comparative-effectiveness studies examining PERMA-based interventions against other established psychological approaches, such as cognitive-behavioral therapy or mindfulness-based interventions, would clarify the specific advantages of the positive psychology framework. Component analysis studies could identify which PERMA elements contribute most substantially to anxiety reduction and quality-of-life improvement, potentially allowing for more streamlined interventions. The

present pattern of findings also suggests plausible mediators, particularly increased perceived social support, greater behavioral engagement with ERAS tasks, and improved illness meaning. Accordingly, future studies should prespecify mediation models with repeated measures to test whether changes in these variables statistically account for improvements in anxiety and quality of life (Götze et al., 2019). Cost-effectiveness analyses and multicenter longitudinal studies will also be important for evaluating implementation at scale.

In conclusion, this randomized controlled trial demonstrates that a PERMA model-based positive psychological intervention significantly reduces preoperative anxiety and improves psychological well-being, fear of cancer recurrence, fertility concerns, quality of life, subjective well-being, social integration, health education acceptance, ERAS protocol adherence, and satisfaction in young female lung cancer patients undergoing day surgery. The intervention's comprehensive approach to fostering positive emotion, engagement, relationships, meaning, and accomplishment addresses the multifaceted psychological needs of this vulnerable population while supporting optimal surgical outcomes. The observed effect sizes and clinically relevant shifts in anxiety caseness support the practical importance of these findings. These results therefore support integration of structured positive psychology interventions into perioperative care pathways for young female lung cancer patients and justify further mechanistic and multicenter evaluation.

Declarations

Ethics approval and consent to participate. This study was conducted in accordance with the declaration of Helsinki.This study was conducted with approval from the Ethics Committee of The Second Affiliated Hospital of Zhejiang University School of Medicine. Written informed consent was obtained from all participants.

Competing Interest. The authors declare that they have no competing interests.

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(IV) Collection and assembly of data: HuangHY and Zhao JF

(V) Data analysis and interpretation: Cao JH, Zhao JF, Qiu QM and Chen Y

(VI) Manuscript writing: All authors

(VII) Final approval of manuscript: All authors

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MINDFULNESS-BASED PSYCHOEDUCATION, BURNOUT, AND COGNITIVE APPRAISAL IN UNIVERSITY STUDENTS: THE NEGATIVE ROLE OF BURNOUT IN PREDICTING LATER MINDFUL ATTENTION

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Abstract

This study examined the associations among participation in a mindfulness-based psychoeducational program, academic burnout, cognitive appraisal, mindful attention, and affect in university students. Using a quasi-experimental, three-wave longitudinal design, 166 students participated in either a mindfulness-based program (n = 64) or a control condition (n = 102). Participants completed measures of burnout, mindful attention, cognitive appraisals, and affect at baseline, midpoint, and post-program. Longitudinal associations were analyzed using cross-lagged panel modeling and mediation analyses within a structural equation modeling framework. Participation in the program was associated with higher mindful attention at post-program. Core burnout emerged as a key mechanism, partially mediating the association between program participation and mindful attention over time. Program participation was modeled as a dichotomous indicator of group membership (0 = control, 1 = program). Although no direct association between program participation and burnout was observed at post-program, significant indirect pathways indicated that lower burnout was associated with subsequent improvements in mindful attention and self-concept of own abilities. In addition, the self-concept of own abilities functioned as a mediator between group membership and later burnout, highlighting the role of secondary cognitive appraisals as personal resources. The findings suggest that mindfulness-based psychoeducational programs in academic settings may support appraisal-related processes and mindful attention, thereby supporting student well-being.

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Keywords: mindfulness, academic burnout, cognitive appraisal, self-concept of own abilities, psychoeducation

Imagine a bright, motivated student struggling under the weight of deadlines, assignments, and personal expectations. As pressure mounts, they begin to experience what once seemed like an adult problem: burnout. Although burnout is originally a work-related concept, studies (Law, 2007; Lin & Huang, 2014; Rosales-Ricardo et al., 2021) have shown that it also occurs in non-work settings, such as school contexts. Students can develop burnout because they undertake activities that can be regarded as "work", such as class attendance, assignment completion, test taking, doing presentations in front of an audience, etc. Previous evidence suggests that higher education is perceived as more challenging and exhausting for students due to increasing academic demands, assignment overload, long working hours, and greater academic pressure compared to other educational levels (Law, 2007).

Given the high incidence rates of student burnout, universities around the world are increasingly focusing on student mental health, often using mindfulness-based interventions. Several meta-analyses (Daya & Hearn, 2018; Dobkin & Hutchinson, 2013; Galante et al., 2018; Lamothe et al., 2016; Lo et al., 2018; McConville et al., 2017; Regehr et al., 2013) have examined their effectiveness, showing mixed results. On the one hand, Hathaisaard et al. (2022) concluded that mindfulness-based interventions can effectively lower stress and prevent burnout among medical students. Similarly, da Silva et al. (2023) reported improvements in mindfulness and psychological well-being, although significant group differences appeared only at follow-up. On the other hand, Lo et al. (2018) found small effects on mindfulness and stress after the intervention, with moderate effects observed at follow-up. Overall, the findings suggest small but promising effects, especially over time, although immediate post-intervention results are often limited.

Mindfulness interventions can help participants in diminishing their emotional reactivity to stressful stimuli, thereby changing how these stimuli are appraised (Arch & Craske, 2006; Creswell et al., 2007). According to the Transactional Model of Stress (Lazarus & Folkman, 1984), the individual's appraisal of the stressor is what determines emotional and physiological responses, not the stressor itself. For example, when academic pressure is perceived as threatening it can lead to higher academic burnout, increased emotional exhaustion, negative attitudes, and lower personal accomplishment in students (Lin & Huang, 2014; Spătaru et al., 2024). Existing studies show mixed results regarding the effectiveness of mindfulness in reducing burnout (Daya & Hearn, 2018; O'Driscoll et al., 2017), but only a small number have examined appraisal as a mechanism of change (Jamieson et al., 2022; Weinstein et al., 2009).

This study aims to address the existing gap in the literature by evaluating the effects of a mindfulness-based psychoeducational program on academic burnout among university students, with a particular focus on cognitive appraisals of stress. Specifically, the present study investigates the potential of mindfulness-related educational practices to influence how students initially appraise academic stress and how subsequent changes in appraisal processes are associated with changes in burnout. Despite the increasing prevalence of burnout among university students, the mechanisms by which academic stress is appraised and how these appraisals contribute to burnout remain poorly understood (Spătaru et al., 2024). Although mindfulness-based programs have been studied in academic contexts, the inconsistent results highlight the need for further investigation into their effectiveness for understanding stress and the role of cognitive appraisal in this process.

The importance of appraisal

The appraisal theory is grounded in the Transactional Model of Stress (Lazarus & Folkman, 1984), and recent studies investigated changes in appraisal as a potential mechanism of workplace mindfulness. In this vein, Jamieson et al. (2022) examined employees' primary appraisal using a longitudinal approach, concluding that mindfulness mediated the relationship between high-activation negative affect and daily threat appraisal. Additionally, daily changes in mindfulness influenced the rate of appraisal change, and daily appraisals were influenced by affect. These results highlight appraisal as a core cognitive process of workplace mindfulness, providing a clear rationale for examining how mindfulness interventions modify appraisal processes.

How mindfulness interventions changed appraisal in previous studies

Mindfulness interventions can foster desensitization and reduce emotional reactivity to potentially threatening situations or stimuli, thus allowing individuals to view stressful situations in more benign or neutral terms (Arch & Craske, 2006; Creswell et al., 2007). Mindful individuals reported less frequent use of avoidant coping strategies and greater use of approach coping, leading to more challenge stress appraisals. Mindfulness may promote a less defensive and more open attitude toward exposure to threatening and challenging situations or experiences, thereby reducing negative cognitive appraisals of those situations and lowering perceived stress. Mindfulness interventions may promote cognitive changes by attenuating negative appraisals of the situation and reducing the tendency to perceive it in stress-inducing ways (Weinstein et al., 2009). In this vein, Chishima et al. (2018) provided evidence that, in the context of a stressful event, cognitive appraisals (threat and

challenge) can mediate the influence of self-compassion, leading to reduced threat appraisal and increased perceived controllability of the stressful event.

Thus, a higher perceived threat can mediate the association between self-compassion and coping strategies. Highly self-compassionate individuals may be more inclined to perceive stressful situations as less threatening and more controllable for themselves. This is because self-compassionate people recognize difficulties as part of their human condition, thus adopting a balanced interpretation rather than over-identifying with them.

Methods

Participants

The participants were 166 university students, divided into two groups: 64 in the program group and 102 in the control group. Although the study did not target a particular gender and included both men and women, the majority of participants in both the mindfulness program group (75%, $n = 64$) and the control group (66.7%, $n = 102$) were women. In the program group, participants ranged in age from 18 to 39 years ($M = 21.8$, $SD = 4.47$), and in the control group, from 18 to 54 years ($M = 21.1$, $SD = 6$). Most participants were bachelor students (program group: $n = 57$, 89.1%; control group: $n = 98$, 96.1%), mainly studying Sociology and Psychology (program group: $n = 47$, 73.4%; control group: $n = 54$, 52.9%). Moreover, the participants studied other domains, such as Political Science, Philosophy, Communication Sciences, Automatic Machines and Computers, and Economics and Business Administration. Participants' socio-demographic characteristics and mental health outcome measures at the pre-test (for the Program and Control groups) are presented in Table 1 in the supplementary material.

Procedure

Recruitment was conducted through printed flyers posted in university hallways, targeted social media communications, and classroom announcements. Students could either enroll in the mindfulness program or complete a series of questionnaires to examine psychological well-being and stress in an academic context, three times during the semester. Students were assigned to the program and control groups based on their interests and schedules; thus, the present study employed a quasi-experimental design. In order to be included in the study, participants had to be university students, fluent in Romanian, and have easy access to the university's classrooms and reading rooms. Regarding the exclusion criteria, students were excluded from the study if they self-reported a prior diagnosis of a psychotic disorder(s).

During the screening phase, the participants were informed about the study requirements, signed the initial consent form, and assessed for eligibility. Students who met the eligibility criteria were invited to enroll in the program and asked to complete a series of questionnaires, including demographic information and outcome measures (burnout, appraisal, subjective well-being, and mindfulness).

The mindfulness-based psychoeducational program was conducted in a university classroom and in the reading room of the university-administered student housing, where the students were divided into small groups (10–15 students per group). The group facilitator was a Ph.D. enrolled in a Cognitive Behavioral Psychotherapy (CBP) training school.

To support participation and reduce attrition, students were offered modest incentives. Participants were eligible to receive a lottery-based gift card upon completing the study questionnaires and attending at least half of the program sessions. Additionally, students from the host university who attended at least four of the seven sessions received course credit, in line with standard educational practice. Participants in the control group who completed the questionnaires also received course credit.

Ethical considerations

The study was conducted as a psychoeducational program in an academic setting and posed minimal risk to participants, with no clinical or therapeutic intervention procedures.

This study procedure was conducted in alignment with the ethical principles outlined in the Declaration of Helsinki. Participation was voluntary, and all participants provided written informed consent prior to participation. All data were stored securely and anonymized prior to analysis.

Formal ethics committee approval was not required for this study, given its minimal risk, psychoeducational nature, and the voluntary participation of university students in non-sensitive activities.

Mindfulness-based psychoeducational program

This mindfulness-based psychoeducational program consisted of seven sessions of relaxation theory protocols and mindfulness guidelines, delivered as a psychoeducational program rather than a clinical or therapeutic intervention. The program was delivered over 7 weeks, during which participants attended weekly sessions that introduced mindfulness concepts and guided practice in an educational format, and were encouraged to practice mindfulness at home.

The program was based on the 'Breathworks for Stress' mindfulness protocol (Burch & Penman, 2015; Sopezki et al., 2020) and incorporated elements from 'Mindfulness-Based Cognitive Therapy for Depression' (MBCT; Segal et al., 2013),

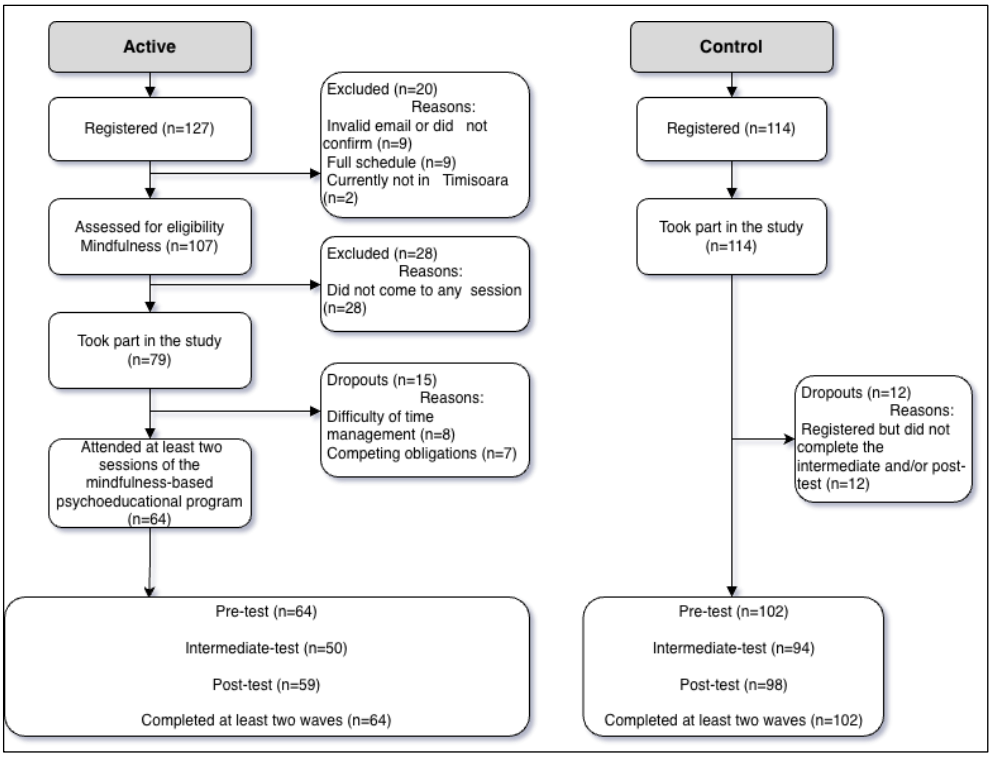
and the Mindfulness-Based Stress Reduction (MBSR) intervention developed by Kabat-Zinn (1982). Although the program drew on established mindfulness-based protocols, it was adapted for educational delivery and did not involve clinical assessment, diagnosis, or treatment.

This program encompassed seven key topics: Body Scan, Mindfulness of Breathing, Mindfulness in Movement, Mindfulness in Emotional Discomfort, Contemplation of the Beautiful, Self-Compassion, and Compassion Meditation (Burch & Penman, 2015). The last recap session, titled 'Life Lives Through You,' aimed to facilitate the integration of what participants learned in the program into their daily lives. The recap session was held last week (session seven), along with the final topic: compassion meditation. From the "Mindfulness-Based Cognitive Therapy for Depression" protocol developed by Segal et al. (2013), some mindfulness practices were selected, including the List of automatic negative thoughts, the Compassionate letter to self, Cultivate and use Allowing/Letting Be, and the Poem "Guest House" by Jalaluddin Rumi. The Mindful Walk practice from Session 5 was omitted due to space constraints, but participants were informed of this and encouraged to practice it outdoors. A detailed overview of the topics covered in each session is provided in Table 2 of the Supplementary Material.

Each session lasted 90 minutes, with daily recommendation practice averaging 10 minutes and suggestions for applying what they've learned to their day-to-day life. During each session, a topic is presented together with related practices and inquiries.

Typically, at the beginning of each 90-minute session, a short oral and video lesson was included to introduce the weekly present topics. In the first session, the students were informed about the program's aims, the philosophy of mindfulness, and the overall psychoeducation. Also, participants were asked to introduce themselves briefly and to mention any constraints that might affect their participation in upcoming sessions, or any reasons for withdrawal or dropout. In the following sessions, at the beginning of each session, the students were informed in a short psychoeducational manner (in the first 30 minutes of each session) about the topic and the theory behind it, including open discussions (for example: What is compassion/ kindness?), thus enthusiastically engaging in learning activities.

The last 30 minutes included stress management group discussions and discussions where the students volunteered to share their meditation experiences with the group, including mindfulness skills related to body-scan, mental exercises that focus on attention on the breath, or being aware of one's own bodily sensations, and during everyday activities, the students learned to practice being fully aware. These discussions aimed to facilitate group members' reflection on what was occurring and what they were experiencing during mindfulness meditation practice.



Note. Assessment counts are wave-specific and represent overlapping groups. Participants who missed the midpoint assessment could return for the post-program assessment; no participants were enrolled after baseline.

Figure 1. Flowchart describing recruitment and dropout for the program and control groups.

Figure 1 presents the study flow diagram, which shows the number of participants, dropouts, and participants' session attendance in the mindfulness program. In the program group, 127 students initially expressed willingness to participate in the study. However, not everyone who enrolled in the study was motivated to complete all stages of the program (i.e., responding to the researcher's email to confirm that their schedule was acceptable and that they would be present, or confirming but not attending any sessions; $n = 20$). Participants were included in the program analyses only if they had attended at least 2 Mindfulness sessions, ensuring adequate educational training, skills development and guided mindfulness learning. Among the 64 program participants included in the analytic sample, all of whom completed the pre-program assessment, 45 provided questionnaire data at both midpoint and post-program, 14 provided post-program but no midpoint data,

and 5 provided midpoint but no post-program data. Thus, 50 participants provided midpoint data and 59 provided post-program data.

Measures

Overall, the scales demonstrated good internal consistency, with Cronbach's α coefficients ranging from 0.63 to 0.90 for the Pre-test, from 0.51 to 0.93 for the Mid-test, and from 0.68 to 0.94 for the Post-test. The internal consistency reliability for each scale is presented in the Supplementary Material (Table 3).

Screening Measures

The *Demographic questionnaire* included items that recorded participants' age, gender, most recent school of graduation, faculty to which they were enrolled, level of schooling, marital and occupational status, and number of children. The questionnaire also recorded students' participation in other forms of psychological program (e.g., Cognitive Behavioral Therapy, Psychodrama) or counseling sessions. Follows a pharmacological treatment recommended by the psychiatrist, and if so, what type of pharmacological treatment follows (name of the drug or substance, and/or the dosage it is known), diagnosed by a specialist with a psychiatric and psychological disorder, and if so, what is its name.

Patient Health Questionnaire (PHQ-9; Spitzer et al., 1999). The Patient Health Questionnaire is a 9-item screening and diagnostic inventory tool for mental health disorders, such as depression, anxiety, alcohol, eating, and somatoform disorders.

The Generalized Anxiety Disorder (GAD-7; Spitzer et al., 2006) is a 7-item self-report anxiety questionnaire that is used as a screening tool and measures how someone has been feeling for the past two weeks. These questions investigate symptoms such as feeling nervous, worrying excessively, having trouble relaxing, feeling afraid, being restless, or becoming easily irritable or annoyed.

Primary Outcome Measures

The Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) is a 15-item questionnaire that assesses the extent to which individuals can attend to present-moment experiences without distraction (e.g., "I rush through activities without being really attentive to them"). Response options ranged from 1 (almost never) to 6 (almost always), with higher scores indicating greater mindfulness or present-moment awareness.

We assessed burnout using *The Burnout Assessment Tool (*BAT; Schaufeli et al., 2020), which has 23 items that assess the four core symptoms of burnout (BAT-C, including emotional exhaustion, mental distancing, cognitive and emotional impairment) and 10 items that investigate the two secondary symptoms of burnout (BAT-S, which include psychosomatic complaints and psychological distress). Both components, BAT-C and BAT-S, respectively, were rated on a five-point Likert scale, ranging from 1 (never) to 5 (always).

We assessed primary and secondary appraisals using *the Primary and Secondary Appraisal* scale (PASA; Gaab et al., 2005). The PASA has 16 items distributed between two scales for assessing primary appraisals (i.e., the threat scale and the challenge scale) and two additional scales for secondary appraisals (i.e., self-concept of own abilities and control expectancies).

Job-related affective well-being (Warr, 1990) is measured using Warr's 12-item scale, with response options ranging from 1 (never) to 6 (all the time). The participants assessed how their school has made them feel over the past few weeks, including items such as "relaxed", "worry", and "tense", etc. Furthermore, the items were comprised into two subscales labeled as ‘‘negative affect’’(NA) and ‘‘positive affect’’ (PA). The high-activation unpleasant affect (HAUA) and low-activation unpleasant affect (LAUA) dimensions form the negative affect (NA) scale, whereas the high-activation pleasant affect (HAPA) and low-activation pleasant affect (LAPA) dimensions form the negative affect (NA) subscale.

Statistical analyses

An independent-samples t-test was conducted to examine whether students who dropped out after the pre-test differed significantly from those who remained in the program group on baseline measures. The goal was to identify potential systematic differences between participants who engaged with the program and those who did not.

SPSS (IBM SPSS Statistics, Version 24) was used to conduct independent sample t-tests, reliability analyses, and descriptive statistics. Structural equation modeling (SEM) and mediation analyses were conducted using the *lavaan* package in R (Rosseel, 2012). The longitudinal effects were examined using a cross-lagged panel model (CLPM) (Kenny & Harackiewicz, 1979), which allows for the simultaneous estimation of autoregressive paths (stability of each construct across time) and cross-lagged paths (the directional influence of one construct on another across time). Program participation, defined as group membership, was modeled as a dichotomous predictor (0 = control, 1 = program) and included as an exogenous variable to examine whether it explained additional variance beyond autoregressive stability effects. Age and gender were not included as covariates in the primary SEM

analyses, including the mediation models and CLPM. This specification focused on the hypothesized longitudinal associations and limited model complexity given the sample size. To examine whether the CLPM findings were sensitive to demographic adjustment, post hoc sensitivity analyses were conducted. The model was first adjusted for age and then for both age and gender.

Missing outcome data were handled using full-information maximum likelihood (FIML; missing = "ML" in lavaan) under the missing-at-random assumption; no imputation was performed. A total of 166 observations were included in the analysis, with 2 distinct missing data patterns. Pattern 1: t1 is missing, t0 and t2 were observed; Pattern 2: t2 is missing, t0 and t1 were observed. Of the 166 participants, 132 provided data at all three assessments, 25 lacked midpoint (t1) data, and 9 lacked post-program (t2) data. These missing-data patterns refer to unavailable questionnaire data, not session attendance. Furthermore, the reasons for missing individual midpoint or post-program questionnaire assessments among participants included in the analytic sample were not collected.

Results

Significant baseline differences were found between participants who dropped out after the pre-test and those who continued in the study. Specifically, dropouts reported higher levels of Core Burnout ($t(222)= 3.62$, $p < .001$) and Negative Affect ($t(222) = 2.56$, $p =.011$), while continuing participants reported higher Challenge appraisal ($t(222) = -2.09$, $p =.004$) (see Table 4 in Supplementary Material). This difference can be explained by the fact that, on average, students who attended at least one mindfulness session had lower burnout and higher challenge appraisal than the other group, suggesting that students experiencing higher psychological strain were less likely to engage with the program. Furthermore, Table 5 in the Supplementary Material presents the correlation analysis among the variables included in this study across all three measurement time points.

Cross-lagged effects

The results of the regression analyses conducted within the structural equation modeling (SEM) framework showed that Mindful attention at Time 2, but not at Time 1, and Core Burnout and Self-concept of own abilities at Time 1, but not at Time 2, were significantly predicted by Program effects (see Table 6 in Supplemental material and Figure 2). Significant autoregressive effects were observed for Mindful Attention at both Time 1 ($B = 0.70$, $SE = 0.07$, $\beta = 0.67$, $p < .01$) and Time 2 ($B = 0.46$, $SE = 0.07$, $\beta = 0.46$, $p < .01$), indicating good temporal stability.

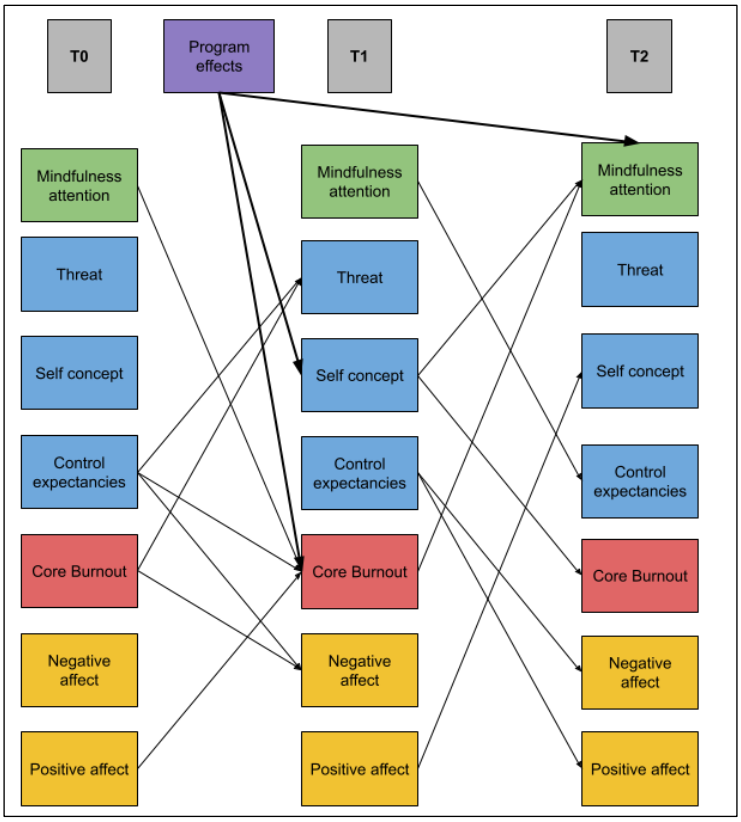


Figure 2. A visual representation of the significant cross-lagged effects for all variables*

* Autoregressive effects were included in all models but are not displayed in this figure

Mindful attention at Time 2 was predicted by past Self-concept of own abilities (B = -0.19, SE = 0.09, β = -0.18, p = .029), and by past Core burnout (B = -0.43, SE = 0.13, β = -0.32, p = .001), suggesting that students with lower baseline burnout and higher perceived abilities tended to report higher mindfulness at the subsequent measurement. Mindful attention at Time 2 was also significantly predicted by Program effects (B = 0.32, SE = 0.10, β = 0.17, p = .002), indicating that the program positively influenced Time 2 mindful attention; more precisely, students in the program group showed an increased mindfulness than those in the control group. Additionally, Core burnout at Time 1 (B = -0.12, SE = 0.05, β = -0.15, p = .010) and Control expectancies at Time 2 (B = 0.15, SE = 0.07, β = 0.17, p = .043) were predicted by past Mindful attention.

Self-concept of own abilities at Time 1 was significantly predicted by past Self-concept of own abilities *(B = 0.*40, SE = 0.10, β = 0.44, p < *.001*), indicating temporal stability, and by Program effects *(B = 0.*31, SE = 0.12, β = 0.18, p = .011)

suggesting that the Program effects influenced the self-concept of own abilities at Time 1. Compared with the control group, students in the program group had a stronger, more positive self-concept of their own abilities. Further, Self-concept of own abilities at Time 2 was significantly predicted by past Self-concept of own abilities (*B = 0*.39, *SE* = 0.09, β = 0.38, *p < .001*), and by past Positive affect (*B = 0*.12, *SE* = 0.06, β = 0.16, *p* = .046).

Core Burnout at Time 1 was significantly predicted by past Core Burnout *(B = 0*.60, *SE* = 0.08, *β* =0.59, *p < .001*), reflecting temporal consistency, and also by past Mindful attention *(B = -0*.12, *SE* = 0.05, β = -0.15, *p* = .010), suggesting that students who reported higher levels of mindful attention also reported lower levels of burnout at the subsequent measurement.

Further, Core Burnout at Time 1 was significantly predicted by past Control expectancies *(B = 0*.10, *SE* = 0.05, β = 0.12, *p* = .05), and by Positive affect (*B = -0*.08, *SE* = 0.04, β = -0.13, *p* = .041). This indicates that students reporting higher control expectancies and lower positive affect at baseline also reported higher levels of core burnout at the subsequent measurement. Moreover, being part of the program group (*B = -0*.15, *SE* = 0.07, β = -0.11, *p* = .032) was associated with lower levels of core burnout at Time 1, indicating a potential protective association against burnout for individuals in this group. Although Control expectancies were marginally significant, a bootstrapping procedure was conducted to assess their significance. When computed with a bootstrapping sample of 1000, the results showed that Control expectancies appraisal was significant at $p < .05$.

Core Burnout at Time 2 was significantly predicted by past Core Burnout *(B = 0*.77, *SE* = 0.07, β = 0.75, *p < .001*), indicating temporal stability. Core Burnout at Time 2 was also predicted by past Self-concept of own abilities (*B = -0*.12, *SE* = 0.05, β = -0.15, *p* = .010), suggesting that students with higher perceived abilities at Time 1 reported lower core burnout at Time 2.

The post hoc sensitivity analyses produced findings similar to those of the primary cross-lagged panel model. After adjustment for age alone and for age and gender jointly, the direction and statistical significance of the group-related associations remained unchanged.

Mediation effects

To examine mediation effects, three models were tested. In each model, the program was specified as the predictor, and one outcome at Time 2 was examined: (1) Mindful Attention, (2) Core Burnout, and (3) Self-Concept. Mediation was tested through mediators measured at Time 1 and Time 2, including Mindful Attention, Core Burnout, and Self-Concept.

Mediation analysis revealed a significant direct effect of the Program effects on Mindful Attention at Time 2 (*B* = 0.33, *SE* = 0.12, β = 0.17, *p* = .004), indicating that participation in the program increased mindfulness independently of

mediators (Table 1). A significant negative indirect effect was found via Core Burnout at Time 1 (B = -0.07, SE = 0.03, β = -0.03, p = .032), suggesting that lower burnout partially mediated the program's impact on Mindful Attention at Time 2. The indirect effect via Self-Concept of own abilities at Time 1 was not significant (B = -0.02, SE = 0.01, β = -0.01, p = .202). The total effect of the program on Mindful Attention at Time 2, combining both direct and indirect paths, was also significant (B = 0.25, SE = 0.12, β = 0.13, p = .039).

Table 1. Standardized direct, indirect, and total effects for the Mindful attention mediation model

Variable	*Type of Effect*	*Est*	*Std.Err*	*z*	*Std.Est*
Program effects Group → Mindful attention (t2)	Direct	**0.332****	0.117	2.848	0.168
Program effects Group → Core Burnout (t1) → Mindful attention (t2)	Indirect Core burnout	**-0.067***	0.031	-2.143	-0.034
Program effects Group → Self-concept of own abilities (t1) → Mindful attention (t2)	Indirect Self-concept	-0.015	0.012	-1.276	-0.008
Program effects Group → Mindful attention (t2)	Total	**0.250***	0.121	2.060	0.126

Note. Program effects Group = Program group membership (0 = control, 1 = program); Self-concept = Self-concept of own abilities; Est = Unstandardized Estimate; Std. Err = Standard Error; z = Z-score; Std.Est = Standardized Estimate; t1 = midpoint; t2 = post-program. *p < .05. **p < .01.

The direct effect of the Program on Core Burnout at Time 2 was not significant (B = -0.01, SE = 0.06, β = -0.01, p = .915). The indirect effect through Mindful Attention at Time 1 was also non-significant (B = 0.04, SE = 0.04, β = 0.02, p = .312). However, a significant negative indirect effect was found through Self-concept of own abilities at Time 1 (B = -0.04, SE = 0.02, β = -0.02, p = .034), indicating that participation in the program was indirectly associated with lower subsequent burnout through enhancements in Self-concept of own abilities.

In other words, higher self-concept of own abilities at Time 1 predicted lower Core Burnout at Time 2. The total effect of the program on Core Burnout at Time 2, combining both direct and indirect effects, was not significant (B = -0.01, SE = 0.07, β = -0.01, p = .912). This indicated that, overall, the Program effects had no significant impact on Core Burnout at Time 2, when considering both direct effects and mediation pathways through Mindful Attention and Self-concept of own abilities at Time 1 (Table 2).

Table 2. Standardized direct, indirect, and total effects for the Core Burnout mediation model

Variable	*Type of Effect*	*Est*	*Std.Err*	*z*	*Std.Est*
Program effects Group → Core Burnout (t2)	Direct	-0.006	0.059	-0.106	-0.005
Program effects Group → Mindful attention (t1) → Core Burnout (t2)	Indirect Mindfulness	0.042	0.041	1.012	0.022
Program effects Group → Self-concept of own abilities (t1) → Core Burnout (t2)	Indirect Self-concept	**-0.044***	0.021	-2.118	-0.023
Program effects Group → Core Burnout (t2)	Total	-0.008	0.073	-0.111	-0.006

Note. Program effects Group = Program group membership (0 = control, 1 = program); Self-concept = Self-concept of own abilities; Est = Unstandardized Estimate; Std. Err = Standard Error; z = Z-score; Std.Est = Standardized Estimate; t1 = midpoint; t2 = post-program. *$p < .05$. **$p < .01$.

The direct effect of the Program on Self-concept of own abilities at Time 2 was negative and not significant (B = -0.08, SE = 0.11, β = -0.05, p = .456). However, a significant negative indirect effect was observed through Core Burnout at Time 1 (B = -0.07, SE = 0.03, β = -0.03, p = .032), suggesting that lower burnout was associated with subsequent improvements in self-concept of own abilities. The indirect effect via Mindful Attention at Time 1 was positive but not significant (B = 0.04, SE = 0.04, β = 0.02, p = .319), indicating it did not mediate the relationship. The total effect of group assignment on Self-concept of own abilities at Time 2 was also not significant (B = -0.11, SE = 0.12, β = -0.06, p = .353), implying no overall impact when considering both direct and indirect paths (Table 3).

Table 3. Standardized direct, indirect, and total effects for the Self-concept of own abilities mediation model

Variable	*Type of Effect*	*Est*	*Std.Err*	*z*	*Std.Est*
Program effects Group → Self-concept of own abilities (t2)	Direct	-0.081	0.108	-0.746	-0.046
Program effects Group → Core Burnout (t1) → Self-concept of own abilities (t2)	Indirect Core burnout	**-0.068***	0.031	-2.148	-0.033
Program effects Group → Mindful attention (t1) → Self-concept of own abilities (t2)	Indirect Mindfulness	0.040	0.040	0.996	0.020
Program effects Group → Self-concept of own abilities (t2)	Total	-0.108	0.117	-0.928	-0.059

Note. Program effects Group = Program group membership (0 = control, 1 = program); Self-concept = Self-concept of own abilities; Est = Unstandardized Estimate; Std. Err = Standard Error; z = Z-score; Std.Est = Standardized Estimate; t1 = midpoint; t2 = post-program. *$p < .05$. **$p < .01$.

Discussion

This study contributed to the growing body of research on psychological factors influencing academic burnout by examining the effects of a mindfulness program on burnout levels, cognitive appraisal, and affect among Romanian university students. While previous studies highlighted the prevalence of stress and burnout in higher education, few examined how mindfulness practices influenced students' cognitive appraisals of stress. Using a quasi-experimental, three-wave design with a control group, this study highlighted the relevance of mindfulness-based psychoeducational programs in academic settings and their potential to support students' appraisal processes and burnout-related experiences over time.

Regarding the study's aim of examining mindfulness-based psychoeducation and academic burnout, the findings were mixed. Program group membership was associated with higher mindful attention at post-program and lower core burnout at midpoint, but not with lower core burnout at post-program. Lower core burnout at midpoint also predicted higher mindful attention at post-program, indicating that earlier burnout levels were relevant to subsequent mindful attention.

Mindful attention

The post-program group showed significant increases in mindful attention compared to the control group, although no such difference was observed during the program period (at the midpoint). The significant direct effect confirmed that the program directly enhanced mindful attention, indicating that the program effectively developed mindful attention and awareness by the end of the program. However, students' mindful attention did not easily increase with fewer than four sessions, and they needed to attend more than four sessions for the change to occur. Although the standard Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1982) program typically included eight weekly sessions, some modifications were implemented. Several meta-analyses that assessed the effectiveness of mindfulness programs in students (da Silva et al., 2023; O'Driscoll et al., 2017) demonstrated that mindfulness-based programs, lasting 4 to 8 weeks, effectively improved students' mindfulness. The positive total effect suggested that the 7-week mindfulness-based program was sufficient for enhancing mindful attention, and the results aligned with previous literature. Therefore, the present study's findings provided evidence for the feasibility of a long-term mindfulness-based program comprising more than 4 sessions to increase mindful attention among university students (Liu et al., 2024).

In addition to this direct effect, core burnout emerged as a key factor influencing effectiveness. Core burnout negatively mediated the relationship between the program group and mindful attention, indicating that the program's effect on mindful attention was achieved through a decrease in core burnout. The

program directly increased mindful attention and primarily lowered core burnout, thereby improving mindful attention. This aligned with earlier findings that higher mindfulness was associated with lower burnout levels (see Luken & Sammons, 2016 for a systematic review). This also suggested that reducing burnout was important for achieving increased mindful attention. Reducing negative states, such as burnout, in the first four weeks of the program facilitated positive outcomes in mindful attention post-program.

Consistent with the transactional stress model (Lazarus & Folkman, 1984), when students experienced stress, they reappraised it and then made cognitive or behavioral adjustments to manage it. Initially, participants who experienced core burnout appraised their situations as more stressful or threatening. After four weeks in the program, participants were equipped with new coping resources, including mindfulness training and strategies to manage and reappraise stress. As core burnout decreased, participants reappraised their situations more positively and no longer perceived their circumstances as overwhelmingly stressful. This positive reappraisal was accompanied by lower perceived emotional burden and stress-related experiences. With lower burnout, participants were able to focus more on the present moment, engage more effectively in mindfulness practices, and enhance their awareness of their internal and external experiences (Luken & Sammons, 2016). This pattern is consistent with previous research suggesting that mindfulness practice is associated with greater self-awareness and may play a role in preventing burnout (Rupert et al., 2015).

Furthermore, these findings were also supported by the Unified Protocol (UP; Barlow et al., 2010), which emphasized emotion regulation and cognitive reappraisal as core practices for reducing burnout and enhancing mindfulness. The Unified Protocol (UP) integrated practices such as increasing emotional awareness, developing cognitive flexibility, and employing adaptive coping strategies to manage emotional distress. These techniques aligned with the observed low levels of core burnout and the subsequent improvement in mindful attention, indicating that this approach effectively complemented mindfulness programs. The UP could establish a comprehensive framework that highlights how mindfulness-based programs improve mindful attention and lower burnout by targeting maladaptive emotional responses and encouraging positive reappraisal.

Core Burnout

Participants in the program group reported significantly lower burnout scores than those in the control group at the midpoint (four weeks after registration), but not at the post-program point. Although mindfulness was generally considered protective against burnout, its indirect effect was insignificant in this model. The results of the present study were partially in line with the results of previous nonrandomized studies on university students, which showed a reduction in burnout

(Garneau et al., 2013); however, in other studies, the results were non-significant (Barbosa et al., 2013; de Vibe et al., 2013; Oró et al., 2021). Possible explanations for the non-observed effects included multiple factors, such as gender differences (de Vibe et al., 2013) and small sample sizes (Barbosa et al., 2013).

Improvements in mindfulness at an earlier time point were not significantly associated with subsequent changes in core burnout; however, group membership was associated with a higher self-concept of one's own abilities at the middle time point, which, in turn, was associated with lower levels of core burnout at the post-program assessment. This significant indirect effect suggests that group-based mindfulness programs focused on enhancing one's self-concept of own abilities could be beneficial for reducing feelings of burnout over time. Self-concept of one's abilities may function as a personal resource associated with lower burnout, potentially through enhanced feelings of personal accomplishment and competence.

Furthermore, one study (Gomes et al., 2013) examined cognitive appraisal as a mediator of the relationship between occupational stress and work burnout among university academic staff. It showed that secondary cognitive appraisals partially mediated this relationship. This highlighted the importance of considering factors that mitigate occupational stress's impact on individuals, such as secondary appraisals. Similarly, cognitive appraisals may have served as important internal resources, providing support (Huang et al., 2015; Mayerl et al., 2016), helping to reduce the imbalance between demands and resources in favor of resources, thus reducing burnout (Bakker & Demerouti, 2007). Moreover, focusing on increasing personal resources, as defined by the Job Demands–Resources (JD-R) model, the self-concept of one's own abilities appraisal may have served as an internal resource that could protect against burnout and buffer against the demands of academic work (Bakker & Demerouti, 2007). Lastly, self-determination theory (Deci & Ryan, 2000) emphasized the importance of autonomy, competence, and relatedness in fostering motivation and psychological well-being. Enhancing one's self-concept of own abilities aligned with the need for competence described by self-determination theory and may be associated with lower burnout through a stronger sense of effectiveness and control over one's environment.

Self-concept of own abilities

Participants in the program group showed a greater increase in self-concept of their abilities than those in the control group, but only at the midpoint of the program, not in the post-program period. Interestingly, mindful attention did not mediate the relationship between group membership and one's self-concept of one's abilities, suggesting that mindful attention did not significantly influence self-concept within the context of this study. Instead, core burnout negatively mediated the relationship between group membership and self-concept of own abilities, suggesting that the program's impact on reducing burnout could lead to later

improvements in self-concept. While the direct and total effects were insignificant, the significant mediation by core burnout highlighted the importance of this factor in enhancing one's self-concept of own abilities following the program. This supported the idea that burnout can negatively impact self-concept and that alleviating burnout might be a crucial precondition for improving academic self-concept. The significant indirect effect highlighted the importance of addressing underlying stress-related issues (e.g., burnout) to promote more adaptive appraisals.

The JD-R model (Bakker & Demerouti, 2017) also helped explain how reducing burnout could positively impact one's self-concept of own abilities, a personal resource. Bakker and Demerouti's (2017) study indicated that job resources could buffer the relationship between job demands and burnout, encompassing opportunities for growth, a variety of skills, autonomy, and performance feedback. Moreover, a systematic review and meta-analysis showed that self-efficacy beliefs represented important, modifiable cognitions that could protect against the negative outcomes of job stress, such as burnout (Brown, 2012; Shoji et al., 2016).

Limitations

Several limitations are important to note. Firstly, possible self-selection bias during recruitment may have affected the results. As students could choose the group in which to participate (the program or passive control group), students in the program group may be more interested, motivated, and focused on managing psychological and personal issues. Notably, baseline differences between students who completed only the pre-test and those who completed at least two assessments suggest possible attrition bias. Although the group-related estimates in the cross-lagged panel model remained similar after adjustment for age and gender, residual confounding remains possible.

Additionally, the sample was gender imbalanced and had small group sizes, which could limit generalizability to the broader student population. Participants did not keep daily records of their mindfulness practice, limiting our ability to examine how daily engagement might influence outcomes. The absence of a later follow-up assessment constrains conclusions regarding the long-term sustainability of the observed effects.

Finally, some participants were in their first year of university, reported that it was their first examination session, and experienced high levels of anxiety. Other participants were in the final year of their bachelor's and master's degrees. During the sessions, they expressed their high stress and anxiety about the final exam and the public presentation of their bachelor's or dissertation thesis. The post-program assessment occurred in the final weeks of the semester, near exam time, and examination-related stress may have influenced participants' responses.

Practical implications

From a practical perspective, the findings suggest that mindfulness-based psychoeducational programs in higher education may benefit from a phased structure that addresses burnout-related strain while developing mindfulness skills. Prior research indicates that core burnout is associated with attentional and cognitive constraints (Deligkaris et al., 2014), which may limit students' capacity to engage fully in mindfulness practice. Programs may therefore consider introducing supportive strategies that target burnout-related processes early on, followed by a gradual emphasis on mindfulness practices as students' attentional and emotional resources become more available. Additionally, programs aimed at supporting students' self-concept of own abilities may need to prioritize appraisal-related processes and personal resources rather than focusing exclusively on mindful attention.

Developing mindfulness-based psychoeducational programs that emphasize secondary appraisal processes and mindful attention may support student well-being by fostering more adaptive stress-related experiences. By addressing burnout-related strain and attentional processes, such programs may be associated with lower perceived stress and greater engagement with academic activities, with potential implications for students' academic functioning.

Conclusion

As university students increasingly face work-like academic demands, they are at heightened risk of academic burnout and stress-related difficulties (Salmela-Aro & Read, 2017). Using a quasi-experimental, three-wave design that compared students who participated in a mindfulness-based psychoeducational program with a control group, the present study examined the associations among mindful attention, cognitive appraisal, affect, and academic burnout over time. The findings suggest that participation in the program, relative to the control condition, was associated with changes in secondary cognitive appraisals and mindful attention, which, in turn, were linked to burnout-related processes. Rather than indicating direct effects, the results highlight appraisal-related mechanisms, particularly self-concept of own abilities, as potential pathways through which mindfulness-based psychoeducational programs may support students' adaptive functioning. Overall, these findings underscore the need for accessible educational programs in academic contexts that foster self-regulation and appraisal skills to support student well-being.

Declarations

Author Contributions:

Dr. Bianca Spătaru designed the study, collected the data, conducted the statistical analyses, and drafted the manuscript.

Dr. Laurențiu P. Maricuțoiu contributed to study design, data interpretation, and critically revised the manuscript.

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EXECUTIVE FUNCTIONS PROFILES IN AUTISM SPECTRUM DISORDER: ASSOCIATIONS WITH BEHAVIORAL AND EMOTIONAL DIFFICULTIES

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Abstract
Children with autism spectrum disorders (ASD) often exhibit deficits in executive functions (EFs), with cognitive flexibility being one of the primary functions affected in ASD. Numerous studies have investigated how these deficits are associated with the socio-emotional difficulties exhibited by children with ASD. In our study, we investigated EF deficits, behavioral flexibility, and how they are associated with behavioral and socio-emotional difficulties. Our sample included 59 children aged 6–14 years (*SD* = 2.09; *M* = 9.85) diagnosed with ASD. Our results showed that EF difficulties in inhibition and regulation correlated most strongly with externalizing and hyperactive behaviors, whereas flexibility difficulties, particularly transitions and generativity, correlated more strongly with internalizing problems, peer difficulties, and reduced prosocial behavior. Regression analyses indicated that flexibility dimensions jointly predicted prosocial behavior, peer problems, and internalizing problems, with transition difficulties as the most consistent independent predictor; age was not associated with flexibility difficulties. These findings indicate that executive and flexibility-related difficulties are differentially linked to distinct behavioral and socio-emotional outcomes in ASD, with implications for targeted intervention. Limitations include the correlational design, informant-based measures, and the absence of a typically developing comparison group.

Keywords: Executive Functioning, Cognitive Flexibility, Behavioral Flexibility, Socio-Emotional Difficulties, Autism Spectrum Disorder (ASD).

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Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by a range of deficits in social interaction, as well as restricted and repetitive patterns of behaviors, interests or activities (American Psychiatric Association, 2022). These restrictive and repetitive behaviors often include a need for routine, difficulty adapting to environmental demands, or behavioral rigidity, characteristics that are associated with less developed cognitive flexibility (D'Cruz et al., 2013).

In addition to the core symptoms, children with ASD also exhibit executive function deficits. These deficits are evident across domains such as cognitive flexibility, inhibition, planning, and working memory. For example, deficits related to cognitive flexibility are highlighted, reflected in difficulty adapting to changes in plans or routines, as well as difficulties in abandoning a previously used strategy when it is no longer useful (De Vries & Geurts, 2012; Landry & Mitchell, 2021). In addition, deficits related to planning can be observed, which may manifest as difficulties in organizing daily activities, managing unstructured periods of time, or maintaining social activities (Dubbelink & Geurts, 2017). Deficits in working memory are also observed, affecting the ability to store and manipulate information in complex tasks (Gathercole et al., 2006). A review study highlighted deficits in verbal working memory in individuals with ASD, which were associated with significant difficulties in adaptive behavior, as well as with more repetitive and restrictive behaviors (Kercood et al., 2014).

Executive function is an umbrella term that encompasses a series of basic cognitive processes that interact to facilitate the conscious direction of behavior toward a specific goal (Barkley, 2012). Executive functioning has recently received substantial attention in the literature, as it plays a central role in the self-regulation of thoughts and emotions, as well as the self-control necessary to achieve a long-term goal (Diamond, 2013). Executive functions, as highlighted in the model proposed by Diamond (2013), include basic processes such as inhibition, working memory, and cognitive flexibility, which support the functioning of other higher-order cognitive processes such as problem-solving, reasoning, or planning, for example.

The literature highlights that executive functions are associated with academic performance (Best et al., 2011; Ramos-Galarza et al., 2019), with better results in math and reading observed in typically developing children with better executive functioning (Ribner et al., 2023), as well as with socio-emotional functioning. For example, in a study conducted on a sample of 267 parents and their preschool-aged children with developmental difficulties, Boise and Knoche (2024) examined the relationship between executive functions, parenting behaviors, and social-emotional competence. The results highlighted a bidirectional correlation between executive function and social-emotional competence in the first year of

kindergarten, suggesting that these two areas of child development influence one another.

In recent years, interest in the study of executive functions has grown, particularly within the context of ASD, with the profile of executive functioning in ASD highlighting a number of deficits in emotional control (Mazefsky et al., 2013) and inhibitory control (Corbett et al., 2009). A more recent meta-analysis supports these findings, highlighting the significant difficulties with emotional regulation that individuals with ASD experience. The results showed that individuals diagnosed with ASD have difficulty managing their emotions and exhibit reduced emotional regulation skills compared to neurotypical individuals. Furthermore, within the group comprising individuals diagnosed with ASD, more maladaptive emotional regulation strategies and fewer adaptive strategies were employed compared to the control group, a finding associated with difficulties in social adaptation and the severity of ASD symptoms (Restoy et al., 2024). At the same time, in children with ASD, cognitive flexibility and planning are marked by significant deficits (Corbett et al., 2009; Lee, 2025), which are often associated with poor adaptive capacity, especially in situations involving social interaction, as well as difficulties in adapting to environmental demands (Panerai et al., 2014). Among these core executive functions, cognitive flexibility is the primary function affected in ASD. For example, the results of a recent meta-analysis conducted by Lage et al. (2023) showed that individuals with ASD exhibit significant difficulties in cognitive flexibility compared to a control group of neurotypical individuals. The meta-analysis included 56 studies involving 2,122 individuals with autism and 2,036 neurotypical subjects, ranging in age from 4 to 85 years. The results revealed a small to moderate effect of these differences in individuals with ASD, manifested as reduced performance on cognitive flexibility tasks, particularly in a higher number of perseverative errors.

Cognitive flexibility is a component of executive function that involves the ability to adopt different perspectives, both spatial and interpersonal, as well as the ability to adapt to changing demands (Diamond, 2013). In children with ASD, one may observe difficulty transitioning from one location to another or from one event to another, rigidity in following specific routines, and an excessive preoccupation with certain objects or activities (Leung & Zakzanis, 2014). Another area of development in which studies have highlighted difficulties related to cognitive flexibility is the socio-emotional domain, with particular emphasis on difficulties in recognizing emotions and in social interactions; both of these components require the ability to adapt flexibly to new situations and contexts (Fabio et al., 2020; Lacroix et al., 2024).

Individuals with ASD often exhibit deficits in cognitive flexibility, which can contribute to behavioral rigidity and make it difficult for them to adapt to new situations. For example, a recent longitudinal study highlights how cognitive differences related to executive functions impact daily functioning and adaptation in children with ASD who do not have an intellectual disability (Pugliese et al., 2015).

The study involved 64 children and adolescents aged 3 to 14 years (at the first assessment) and 7 to 23 years (at the last assessment), diagnosed with ASD. The results showed that executive functions predicted adaptive behavior regarding daily living skills and socialization, indicating that the more marked the deficits in executive functions, the more autonomy and daily functioning are affected. At the same time, executive difficulties predicted subsequent socialization problems and reduced social adaptation. More specifically, the authors suggest that difficulties with cognitive flexibility (shifting) may contribute to difficulties in socialization and in adapting to new situations, whereas deficits in working memory and planning may impact how daily activities and autonomy are managed.

Furthermore, for children with ASD, similar to typically developing children, studies highlight the role that cognitive flexibility plays in academic outcomes or how it impacts quality of life (De Vries & Geurts, 2015; St John et al., 2017). The results of the study published by St John et al. (2017) highlight the impairment of quality of life in children with autism, particularly in the socio-emotional domain, showing that the severity of autistic traits on the one hand and deficits in cognitive functioning on the other contribute to this reduction in quality of life.

Previous studies indicate that executive processes involved in behavioral regulation, such as cognitive flexibility (shifting), inhibition, and emotional control, are associated with impaired social functioning in children with ASD (Leung et al., 2015). The study conducted by Bertollo et al. (2019) revealed that social flexibility and the ability to adapt to changes and transitions in routine significantly contribute to the development of adaptive social behavior and socio-communicative skills in ASD. In a review, conducted by Cai et al. (2018) addressed the difficulties with emotional regulation that individuals with ASD often experience, difficulties characterized by the atypical use of adaptive emotional regulation strategies. The authors also emphasize that deficits in cognitive flexibility and executive functions represent valuable potential mechanisms to consider in future research, suggesting that the relationship between coping strategies and the use of flexible adaptation strategies appears to be an important component of stress adaptation in ASD.

At the same time, recent literature suggests that the difficulties with cognitive flexibility frequently reported in ASD may be associated with a higher likelihood of developing anxiety. Mahmud et al. (2025) investigated the associations between cognitive flexibility and anxiety in a study conducted on a sample of forty children with ASD aged 8–17 years. The results identified reduced cognitive flexibility in daily life as a significant predictor of anxiety. Similarly, a meta-analysis that included 58 studies (N = 8,292) showed that individuals exhibiting high levels of anxiety (general population) also had deficits in attentional and cognitive control, with the most marked deficits occurring in tasks involving domains such as inhibition and cognitive flexibility (switching) (Shi et al., 2019).

Research on cognitive flexibility in ASD examines several types of cognitive flexibility. Strang et al. (2017) identified five main dimensions of cognitive flexibility in ASD through the development of The Flexibility Scale (FS): routines/rituals; transitions/change; special interests; social flexibility, and generativity. Routines/rituals refer to the need for routine and ritualized behaviors; transitions/change address behaviors marked by rigidity in relation to change; special interests analyze the intensity of narrow interests, as well as how they interfere with social functioning; social flexibility examines difficulties in social reciprocity and how responses are adjusted according to context; and generativity examines the ability to generate new ideas and think outside the box (Petrolini et al., 2023). Thus, the use of the scale in our study allows us to conduct a more nuanced analysis of flexibility in ASD, examining not only the overall level of inflexibility but also the specific domains in which adaptation is most frequently impaired.

Most studies in the literature investigate the overall level of cognitive flexibility, with less emphasis on its multidimensional profile. Furthermore, the relationship between deficits in cognitive flexibility and socio-emotional and behavioral functioning, as well as age-related variations, remains under-researched. Thus, our study aims to analyze the level of executive functioning difficulties in areas such as working memory, planning, inhibition, and emotional regulation, as well as difficulties in cognitive flexibility. At the same time, we will investigate the relationship between cognitive flexibility and socio-emotional and behavioral problems. An additional objective is to identify the subtypes of cognitive flexibility that will exhibit the most marked deficits and to explore age-related variations in flexibility.

Based on the study objectives and previous research, the following hypothesis were formulated:

H1: Higher executive functioning difficulties will be associated with greater socio-emotional difficulties.

H2: Higher executive functioning difficulties will be associated with greater behavioral difficulties.

H3: Higher executive functioning difficulties will be associated with less prosocial behaviors.

The following research questions were also addressed:

RQ1: Which cognitive flexibility subdomains show the highest levels of difficulty in the ASD sample?

RQ2: What is the relationship between children's age and flexibility difficulties in children with ASD?

RQ3: Do cognitive flexibility difficulties predict internalization or externalization problems?

Methods

Design

This study employed a quantitative, non-experimental, cross-sectional, and correlational design to investigate the relationships between executive functions, cognitive/behavioral flexibility, and behavioral and socio-emotional difficulties in children with ASD. At the same time, in our study we sought to explore the associations between behavioral flexibility and behavioral and socio-emotional functioning, as assessed by the SDQ. The research design allowed us to analyze the associations among the variables under investigation, as well as to examine the contribution of different components of behavioral flexibility in explaining the variation in socio-emotional and behavioral difficulties.

Participants

The final analytic sample included 59 children with a recorded diagnosis of ASD. Children were aged between 6 and 14 years, with a mean age of 9.85 years (*SD* = 2.09; media*n* = 10). The age range of 6–14 years was selected because this developmental window is characterized by substantial and rapid maturation of executive functions (Best et al., 2011), alongside the emergence and consolidation of socio-emotional difficulties that become increasingly apparent as children navigate more complex academic and social demands. The sample included 42 boys (71.2%) and 17 girls (28.8%), indicating a predominance of male participants. The gender distribution of the sample is consistent with the higher prevalence of ASD diagnoses in males reported in the epidemiological literature (e.g., a ratio of approximately 3:1 to 4:1; Loomes et al., 2017), rather than reflecting a sampling bias. Questionnaires were completed by adult respondents aged between 22 and 50 years, with a mean age of 26.53 years (*SD* = 6.80; median = 23). Most respondents reported relatively limited professional experience with children in the relevant age group. Specifically, 40% had less than one year of experience, and 32% had between one and three years of experience. Smaller proportions reported three to five years of experience (9%), five to ten years of experience (5%), or more than ten years of experience (14%). Respondents represented a range of professional backgrounds, including psychopedagogy, psychology, primary education, preschool education, speech therapy/logopedics, student roles, and support or mentoring roles. The largest professional group consisted of respondents working in psychopedagogy, special psychopedagogy, or psychology-related fields (22.0%), followed by primary school teachers (16.9%) and preschool educators (15.3%). Most respondents reported university-level, bachelor-level, or field-specific studies (82%), while 18% reported master-level studies.

Participants were drawn from a variety of educational and therapeutic contexts, including special or inclusive educational settings, mainstream schools, preschool settings, and private practice or therapy contexts. Geographically, 42.4% of respondents were from the Cluj/Cluj-Napoca area, while 57.6% were from other localities across Romania. Overall, the sample reflects a group of school-aged children with ASD assessed by respondents with educational, therapeutic, or support-related professional backgrounds.

Instruments

Strengths and difficulties questionnaire (SDQ) (Goodman, 1997) measures behavior and emotional difficulties in children and adolescents via parent and teacher ratings or self- assessment. The parent/ teacher version consists of 5 scales with scores ranging from 0 to 2: emotional problems, hyperactivity, conduct problems, peer problems, and prosocial scale. By combining the scores, a total difficulties scores can be obtained, ranging from 0 to 40. Internal consistency is acceptable for research (mean alpha Cronbach of 0.73; Goodman, 2001). It has good stability computed for a reported time interval of 4–6 months (mean correlation of 0.62; Goodman, 2001). The SDQ total difficulties scale showed lower internal consistency, $\alpha = .580$.

The Flexibility Scale (The Flexibility Scale - FS) (Strang et al., 2017) is composed of 5 subscales (routines/rituals; transitions/change; special interests; social flexibility and generativity). The items are formulated as behaviors or characteristics of the child. Rating is done by the parent or teacher on a scale from 0 to 3, where 0 = no, 1 = somewhat, 2 = very much, 3 = always. Higher scores mean greater recognition of problems/characteristics (e.g. item: Has difficulty when it comes to changing routine/program. SF total scale demonstrated acceptable reliability, $\alpha = .774$.

Childhood executive functioning inventory for parents and teachers (CHEXI) (Thorell & Nyberg, 2008) is 24 item rating scale that measures working memory, planning, inhibition, and regulation. The assessment tool is designed for parents and teachers to measure executive functioning in children aged 4 to 12 years. The questionnaire consists of 24 items. Item scores are summed into 4 subscales (working memory, planning, regulation and inhibition), in addition by summing the scores for the first two subscales an index for WM is obtained, and for the next two an index for inhibition is obtained. Reporting is on a scale from 1 to 5, where 1 = definitely not true and 5 = definitely true. Internal consistency was assessed using Cronbach's alpha. The CHEXI total scale showed excellent reliability, $\alpha = .903$.

Procedure

The study was conducted in accordance with the ethical norms and standards established by the Ethics Committee of Babeș-Bolyai University. Before completing

the questionnaires, each respondent provided informed consent through an online form. Participants were recruited from various educational and therapeutic settings in Romania, including mainstream schools, special education schools, private practices, and so on. The final sample included 59 children with a documented diagnosis of autism spectrum disorder, aged 6 to 14 years. Data were collected via an online form completed by respondents who interacted directly with the children during educational, therapeutic, or support activities. During the data collection phase, respondents completed a set of standardized questionnaires designed to assess the children's executive functions, behavioral flexibility, and behavioral and socio-emotional functioning. To assess executive functions, we used the CHEXI, to investigate cognitive and behavioral flexibility, we applied the FS Scale, and to assess socio-emotional and behavioral difficulties, we used the SDQ. All instruments were completed by the participants' teachers, who had regular and direct classroom contact with the children and were therefore familiar with their behavior, executive functioning, and socio-emotional presentation in the school setting. Subsequently, the collected data were entered into a database and statistically analyzed. First, to characterize the sample and the main variables we investigated, we performed descriptive statistics; we then tested the normality of the study's main variables using the Shapiro-Wilk test. Results indicated that all variables were normally distributed, with W values ranging from .97 to .99 and p-values greater than .05, suggesting no significant deviation from a normal distribution. Then, to examine the relationship between executive functions, behavioral flexibility, and the participants' behavioral and socio-emotional functioning, we performed Pearson correlation analyses. Statistical significance was determined using a strict decision rule ($p < .05$); accordingly, p-values equal to or greater than .05 were interpreted as non-significant. In a final phase, we performed multiple linear regression analyses to investigate whether the dimensions of behavioral flexibility predicted the behavioral and socio-emotional difficulties we assessed using the SDQ in the group of children with ASD.

Preliminary analysis

In the present ASD sample, executive functioning difficulties were most pronounced in the working-memory domain, with both the WM Index and the Working Memory subscale showing the highest relative scores among the CHEXI indices (see Table 1). Inhibition-related difficulties, captured by the Inhibition Index, were comparatively lower but still elevated relative to typically developing samples reported in previous studies. Because the CHEXI does not provide established clinical cut-off scores, these results were interpreted descriptively by comparison with mean scores reported in previous studies, rather than against a fixed diagnostic threshold.

The working-memory and inhibition index scores in the present ASD sample were higher than those reported for the Belgian sample described by Catale et al. (2015). The Belgian sample obtained a mean working-memory score of 23.60 (*SD* = 6.12) and a mean inhibition score of 26.20 (*SD* = 7.24), compared with 47.17 and 39.99, respectively, in the present sample. The current scores were also higher than those reported in the Swedish sample, in which the mean working-memory score was 22.05 (*SD* = 7.17) and the mean inhibition score was 20.66 (*SD* = 7.41). Descriptively, the largest difference was found for working memory, suggesting that working-memory and planning-related executive difficulties were particularly pronounced in the present ASD group.

A similar pattern was observed when the present findings were compared with the typically developing sample reported by Costescu and Opre (2024). The ASD sample from the present study had the CHEXI total mean of 87.16 (*SD* = 16.23), compared with a mean of 60.80 (*SD* = 18.36) in the typically developing sample. This represents a descriptive mean difference of 26.36 points, with the ASD sample showing the higher overall level of executive-functioning difficulty.

The same tendency was evident at the subscale level. Relative to the scores reported by Costescu and Opre (2024), the present ASD sample showed higher mean scores for working memory (*M* = 31.95, *SD* = 7.20 vs. *M* = 22.60, *SD* = 8.21), planning (*M* = 15.22, *SD* = 3.34 vs. *M* = 10.18, *SD* = 3.58), behavior regulation (*M* = 19.11, *SD* = 3.93 vs. *M* = 13.32, *SD* = 4.51), and inhibition (*M* = 20.88, *SD* = 4.89 vs. *M* = 12.55, *SD* = 4.32). The descriptive mean differences were 9.35 points for working memory, 5.04 points for planning, 5.79 points for behavior regulation, and 8.33 points for inhibition.

Overall, these comparisons indicate that children with ASD in the present sample displayed descriptively elevated executive-functioning difficulties relative to the Belgian and Swedish comparison samples and to the typically developing sample reported by Costescu and Opre (2024). The pattern was evident across all CHEXI domains but appeared especially marked for working memory and inhibition. Higher CHEXI scores reflect greater executive-functioning difficulty; therefore, the elevated scores suggest more pronounced difficulties with retaining and manipulating information, planning and organizing behavior, regulating actions, and suppressing inappropriate or impulsive responses.

These comparisons should nevertheless be interpreted cautiously. They are based on descriptive differences between independently recruited samples rather than on direct statistical tests. Differences in participant age, diagnostic composition, cultural and linguistic context, recruitment procedures, informants, and CHEXI scoring or administration may contribute to differences in mean scores. Accordingly, the results support a pattern of elevated executive-functioning difficulties in the present ASD sample, but they do not establish that the groups differ statistically or that ASD status alone accounts for the observed differences.

Table 1. Descriptive Statistics for CHEXI Measures in the ASD Diagnostic Group

Variable	*M*	*SD*	Min–Max
Working Memory	31.95	7.20	16–45
Planning	15.22	3.34	7–20
Behavior Regulation	19.11	3.93	8–25
Inhibition	20.88	4.89	7–30
Inhibition Index	39.99	7.62	16–55
WM Index	47.17	10.02	26–65

Note. $N = 59$. *M* = mean; *SD* = standard deviation. Higher CHEXI scores indicate greater executive-functioning difficulties.

Using the newer four-band SDQ categorization for teacher-completed questionnaires, the ASD sample displayed a generally elevated profile of behavioral and socio-emotional difficulties. The mean total difficulties score was 19.08 falling within the high range; almost three-quarters of the children were classified in the elevated categories, with 30.5% in the high range and 44.1% in the very high range (see Table 2). Difficulties were particularly prominent in the domain of peer problems, where only 5.1% of children were classified as close to average, while 28.8% fell in the high range and 39.0% in the very high range. A similarly marked pattern emerged for prosocial behavior, for which lower scores indicate greater difficulty: 44.1% of the sample fell in the very low range, and a further 6.8% fell in the low range, indicating that impaired prosocial functioning was common in this group. Emotional and conduct difficulties were also evident, although to a somewhat lesser degree. For emotional symptoms, 37.3% of children were classified as very high and 16.9% as high; for conduct problems, 20.3% were classified as high and 20.3% as very high. In contrast, hyperactivity/inattention appeared comparatively less elevated in this sample, with 55.9% of children falling within the close-to-average range and only 13.6% classified as high or very high. Taken together, these findings indicate that children with ASD in this sample presented substantial overall difficulties on the SDQ, most notably in the domains of peer relationships and prosocial behavior, accompanied by additional emotional and conduct-related difficulties, whereas hyperactivity/inattention was relatively less prominent.

Table 2. Descriptive Statistics for SDQ Subscales in the ASD Group ($N = 59$)

Subscale	*M*	*SD*	Min	Max
Conduct Problems	3.05	2.11	0.00	7.00
Hyperactivity/Inattention	6.44	2.09	1.00	10.00
Emotional Symptoms	4.56	2.40	0.00	10.00
Peer Problems	5.03	1.99	0.00	9.00
Prosocial Behavior	4.41	2.72	0.00	10.00
Internalizing Problems	9.59	3.48	3.00	19.00
Externalizing Problems	9.49	3.64	3.00	17.00

Note. SDQ = Strengths and Difficulties Questionnaire. Internalizing Problems = Emotional Symptoms + Peer Problems; Externalizing Problems = Conduct Problems + Hyperactivity/Inattention. Lower scores on Prosocial Behavior indicate greater difficulty.

The Social Flexibility (SF) scores of the present ASD sample ($N = 59$) were compared with the ASD sample reported by Strang et al. (2017), the original validation study of the Flexibility Scale. The present sample showed a higher total flexibility problems score ($M = 45.66$, $SD = 10.15$) than the ASD sample reported by Strang et al. ($M = 36.86$, $SD = 11.78$), indicating greater overall flexibility difficulties (see Table 3).

At the subscale level, the largest difference was observed for Routines/Rituals, where the present sample obtained substantially higher scores ($M = 6.24$, $SD = 3.69$) than the Strang et al. sample ($M = 3.13$, $SD = 3.11$). Higher scores were also observed for Social Flexibility ($M = 10.05$, $SD = 2.41$ vs. $M = 8.21$, $SD = 3.20$) and Generativity ($M = 9.50$, $SD = 2.84$ vs. $M = 7.27$, $SD = 3.11$).

In contrast, scores for Transitions/Change ($M = 10.65$, $SD = 4.72$ vs. $M = 9.47$, $SD = 5.09$) and Special Interests ($M = 9.23$, $SD = 4.14$ vs. $M = 8.77$, $SD = 3.72$) were broadly comparable to those reported by Strang et al. Overall, this pattern suggests that the present ASD sample was characterized by elevated flexibility difficulties, particularly in routines/rituals, social flexibility, and generativity, while transition-related difficulties and special interests were more similar to those observed in the original ASD validation sample.

Table 3. Descriptive Statistics for SF Subscales in the ASD Group ($N = 59$)

Subscale	*M*	*SD*	Min	Max
Routines/Rituals	6.24	3.69	0.00	15.00
Transitions/Change	10.65	4.72	0.00	21.00
Special Interests	9.23	4.14	0.00	18.00
Social Flexibility	10.05	2.41	3.00	15.00
Generativity	9.50	2.84	2.00	12.00
Total Flexibility	45.66	10.15	20.00	68.00

Note. SF = Social Flexibility Scale.

Main analysis

Pearson correlation analyses were conducted to examine the associations between the CHEXI dimensions and SDQ domains among participants with ASD ($N = 59$) (see Table 4). All tests were two-tailed. Conduct problems displayed a selective pattern of associations with executive-function measures. Conduct problems were significantly associated with planning, behavior regulation, inhibition, and the inhibition index, whereas associations with working memory and the working-memory index did not reach significance (see Table 4). This pattern

suggests that conduct problems were more closely linked to inhibitory and behavioral-regulation difficulties than to working-memory difficulties (Berlin & Bohlin, 2002), consistent with prior research emphasizing the role of inhibitory control, rather than working memory, in externalizing behavior. Hyperactivity showed the most consistent pattern of associations across executive-function dimensions, correlating significantly with all six CHEXI measures, with the strongest association observed for the inhibition index (see Table 4). This broad pattern aligns with prior findings linking hyperactivity to widespread executive dysfunction, particularly within the inhibitory-control domain.

Emotional problems showed a markedly weaker and more limited pattern of association with executive functioning, reaching significance only for working memory (see Table 4). This suggests that, in the present sample, emotional symptoms were not systematically related to the executive-function dimensions assessed by the CHEXI. Peer problems were significantly associated with working memory, behavior regulation, inhibition, and the inhibition index, while associations with planning and the working-memory index did not reach significance (see Table 4). Although these associations were modest in magnitude, they suggest that behavioral-regulation and inhibitory difficulties may be particularly relevant to peer-relationship problems, in line with previous work linking self-regulatory skills to social functioning.

Prosocial behavior was negatively associated with most CHEXI dimensions, with the strongest association observed for behavior regulation (see Table 4), indicating that greater behavioral-regulation difficulty was particularly linked to lower prosocial functioning. This finding is consistent with prior literature identifying behavioral regulation as a key correlate of prosocial competence.

Internalizing problems showed small but significant positive associations with several CHEXI measures, notably working memory and inhibition-related indices, while associations with planning and behavior regulation did not reach significance (see Table 4). This indicates that the link between executive-function difficulties and internalizing symptoms, while present, was relatively weak and not uniform across executive domains, broadly consistent with mixed findings in the literature regarding internalizing–EF associations.

Externalizing problems were significantly associated with every CHEXI measure, with the largest correlations observed for inhibition and the inhibition index (see Table 4), underscoring a particularly close relationship between externalizing difficulties and inhibitory control. This is consistent with a substantial body of prior research identifying inhibitory control as a central executive correlate of externalizing behavior.

Table 4. *Correlations Between CHEXI Subscales and SDQ Subscales*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Working Memory	—												
2. Planning	.776**	—											
3. Behavior Regulation	.677**	.610**	—										
4. Inhibition	.484**	.500**	.486**	—									
5. Inhibition Index	.660**	.636**	.828**	.892**	—								
6. WM Index	.978**	.891**	.690**	.515**	.687**	—							
7. Conduct Problems	.187	.214*	.268*	.442**	.422**	.206	—						
8. Hyperactivity	.365**	.303**	.401**	.420**	.476**	.363**	.501**	—					
9. Emotional Problems	.217*	.059	.032	.158	.118	.176	.355**	.145	—				
10. Peer Problems	.216*	.141	.252*	.253*	.292**	.202	.353**	.277**	.251*	—			
11. Prosocial Behaviors	-.365**	-.300**	-.509**	-.209	-.397**	-.363**	-.316**	-.320**	.010	-.365**	—		
12. Internalization Problems	.273*	.121	.166	.254*	.249*	.237*	.447**	.218*	.833**	.745**	-.202	—	
13. Externalization Problems	.318**	.299**	.386**	.497**	.518**	.328**	.867**	.866**	.289**	.364**	-.367**	.407**	—

Note: N = 59. Values are Pearson correlation coefficients. *p* values are two-tailed. * $p < .05$. ** $p < .01$

Pearson correlation analyses were used to examine associations between the Social Flexibility (SF) scale dimensions and SDQ domains (see Table 5). Routines/rituals were positively associated with conduct problems, emotional problems, peer problems, internalizing problems, and externalizing problems, and negatively associated with prosocial behavior (see Table 5). The association with hyperactivity was not statistically significant. Thus, greater routine-related difficulty was linked to a broad pattern of emotional, peer, conduct, and composite SDQ problems, but not clearly to hyperactivity.

Transition difficulties demonstrated the most consistent associations among the individual SF subscales, correlating significantly and positively with all SDQ problem domains, including, notably, hyperactivity, which was not significantly related to routines/rituals and negatively with prosocial behavior (see Table 5). The largest association involved internalizing problems, suggesting that difficulty adapting to changes and transitions may be particularly relevant to emotional and peer-related difficulties in this group.

Special interests showed a more selective pattern, correlating significantly only with peer problems and internalizing problems (see Table 5); associations with conduct problems, hyperactivity, emotional problems, prosocial behavior, and externalizing problems were not significant. This pattern suggests that greater special-interest-related difficulty may be connected primarily to social and internalizing difficulties rather than to disruptive or externalizing behavior.

Social flexibility was negatively associated with prosocial behavior and positively associated with peer problems, with no significant associations found for conduct problems, hyperactivity, emotional problems, internalizing problems, or externalizing problems (see Table 5). Social-flexibility difficulty therefore appeared to have a relatively specific relationship with social functioning, particularly reduced prosocial behavior and increased peer difficulties.

Generativity was negatively correlated with prosocial behavior and positively correlated with peer problems and hyperactivity, with no significant associations for conduct problems, emotional problems, internalizing problems, or externalizing problems (see Table 5). The strongest association was the negative correlation with prosocial behavior, indicating that greater generativity-related difficulty was associated with lower levels of constructive and socially responsive behavior.

The SF total score showed significant associations with every SDQ domain, positively with conduct problems, hyperactivity, emotional problems, peer problems, internalizing problems, and externalizing problems, and negatively with prosocial behavior (see Table 5). The largest associations involved peer problems, prosocial behavior, and internalizing problems, indicating that overall SF difficulty was particularly related to social and internalizing functioning.

Table 5. Pearson Correlations Between SF Scale Subscales and SDQ Subscales for Diagnostic Group 1

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Conduct Problems	—												
2. Hyperactivity	.529**	—											
3. Emotional Problems	.375**	.283**	—										
4. Peer Problems	.360**	.279**	.274**	—									
5. Prosocial Behaviors	-.284**	-.295**	-.026	-.409**	—								
6. Internalization Problems	.461**	.352**	.837**	.756**	-.251**	—							
7. Externalization Problems	.865**	.884**	.375**	.364**	-.331**	.462**	—						
8. Routines	.311**	.147	.276**	.298**	-.299**	.358**	.258**	—					
9. Transitions	.346**	.190*	.357**	.425**	-.288**	.485**	.303**	.677**	—				
10. Special Interests	.160	.069	.061	.277**	-.125	.199*	.129	.507**	.497**	—			
11. Social Flexibility	.017	.029	.020	.196*	-.411**	.125	.026	-.073	.028	-.100	—		
12. Generativity	.044	.212*	-.013	.295**	-.455**	.159	.149	.043	.100	-.047	.428**	—	
13. SF Total	.314**	.211*	.258**	.487**	-.458**	.453**	.298**	.775**	.843**	.700**	.262**	.381**	—

Note: N = 59. Values are Pearson correlation coefficients. All tests are two-tailed. * $p < .05$. ** $p < .01$.

Regression analysis

A series of simultaneous multiple regression analyses was conducted to examine whether the five SF dimensions routines, transitions, special interests, social flexibility, and generativity jointly predicted each SDQ outcome (see Table 6). The five predictors collectively accounted for a significant proportion of the variance in peer problems, $R^2 = .265$, adjusted $R^2 = .196$, $F(5, 53) = 3.82$, $p = .005$; prosocial behavior, $R^2 = .361$, adjusted $R^2 = .300$, $F(5, 53) = 5.98$, $p < .001$; and internalizing problems, $R^2 = .257$, adjusted $R^2 = .187$, $F(5, 53) = 3.67$, $p = .006$. Thus, the five SF dimensions explained 26.5% of the variance in peer problems, 36.1% of the variance in prosocial behavior, and 25.7% of the variance in internalizing problems.

Within the peer-problems model, none of the individual SF dimensions made a statistically significant unique contribution, although transitions approached significance, $\beta = .331$, $p = .052$, as did generativity, $\beta = .223$, $p = .095$. In the prosocial-behavior model, social flexibility, $\beta = -.295$, $p = .020$, and generativity, $\beta = -.310$, $p = .014$, were significant negative predictors. Therefore, higher scores on these SF dimensions were associated with lower prosocial-behavior scores after controlling for the other SF dimensions. Given that lower SDQ prosocial scores indicate greater difficulty, these findings reflect poorer prosocial functioning. In the internalizing-problems model, transitions was the only significant unique predictor, $\beta = .442$, $p = .011$, indicating that greater difficulty with transitions was associated with higher levels of internalizing problems.

The overall models did not significantly predict conduct problems, $R^2 = .133$, adjusted $R^2 = .051$, $F(5, 53) = 1.62$, $p = .170$; hyperactivity/inattention, $R^2 = .079$, adjusted $R^2 = -.008$, $F(5, 53) = 0.91$, $p = .482$; emotional problems, $R^2 = .158$, adjusted $R^2 = .078$, $F(5, 53) = 1.99$, $p = .096$; or externalizing problems, $R^2 = .114$, adjusted $R^2 = .030$, $F(5, 53) = 1.36$, $p = .254$. Although transitions was a significant positive predictor of emotional problems, $\beta = .373$, $p = .041$, this result should be interpreted cautiously because the overall emotional-problems regression model was not statistically significant. None of the SF dimensions uniquely predicted conduct problems, hyperactivity/inattention, or externalizing problems. Overall, these findings suggest that the SF dimensions were most strongly associated with prosocial behavior, peer problems, and internalizing problems, with transitions, social flexibility, and generativity making the most notable unique contributions.

Table 6. Simultaneous Multiple Regression Analyses Predicting SDQ Outcomes from Social Flexibility Dimensions (N = 59)

SDQ Outcome	R^2	Adj. R^2	$F(5, 53)$	Model p	Routines	Transitions	Special Int.	Soc. Flex.	Generativity
Conduct problems	.133	.051	1.62	.170	.160	.262	-.050	.016	.002
Hyperactivity/Inattention	.079	-.008	0.91	.482	.040	.155	-.025	-.071	.224
Emotional problems	.158	.078	1.99	.096	.125	.373*	-.188	.034	-.079
Peer problems	.265	.196	3.82	.005**	.006	.331†	.131	.105	.223†
Prosocial behavior	.361	.300	5.98	< .001***	-.255	-.074	-.003	-.295*	-.310*
Internalizing problems	.257	.187	3.67	.006**	.089	.442*	-.054	.082	.073
Externalizing problems	.114	.030	1.36	.254	.111	.236	-.042	-.034	.133

Note. Entries under predictor columns are standardized regression coefficients (β). Five SF dimensions (Routines, Transitions, Special Interests, Social Flexibility, Generativity) were entered simultaneously in each model. The SF total score was excluded because it is a composite of the predictors.

Association between children's age and cognitive flexibility

The relationship between children's age and flexibility difficulties was examined by plotting SF total scores across age. Visual inspection of the scatterplot indicated no clear age-related pattern in flexibility scores (see Figure 1). Consistent with this observation, the correlation between age and SF total score was not statistically significant, r = -.016, p = .894. These findings suggest that, within the age range represented in the present sample, flexibility difficulties remained relatively stable and did not vary systematically as a function of age.

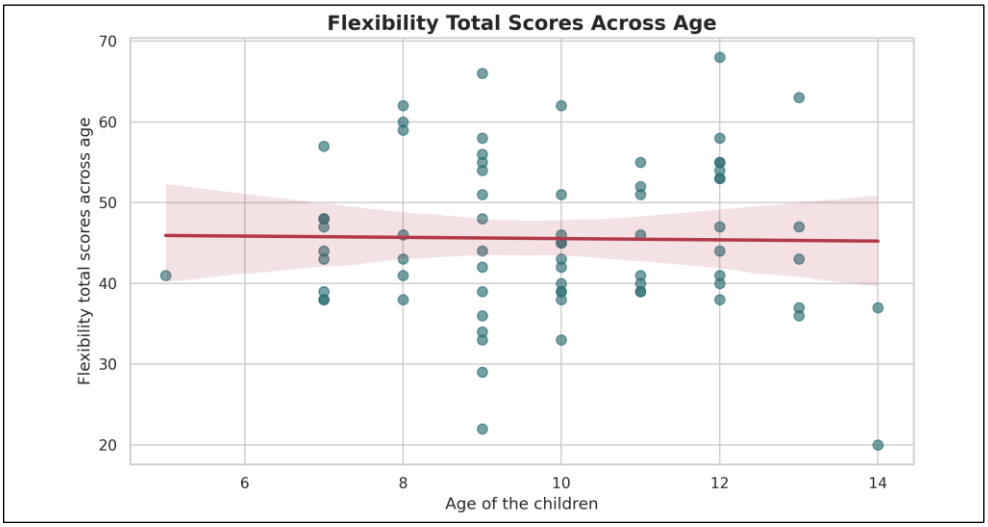


Figure 1. Flexibility total scores across age.

Cognitive flexibility subdomains

To identify the most marked cognitive flexibility difficulties in the ASD sample, SF subdomain scores were converted into percentages of their maximum possible values (see Figure 2). This approach allowed direct comparison across subdomains with different score ranges. The highest relative difficulty was observed for generativity, followed by social flexibility. In contrast, special interests, transitions/change, and routines/rituals showed lower relative scores. These findings suggest that the most prominent flexibility-related difficulties in the present sample were related to generating flexible ideas or responses and adapting behaviour in social contexts.

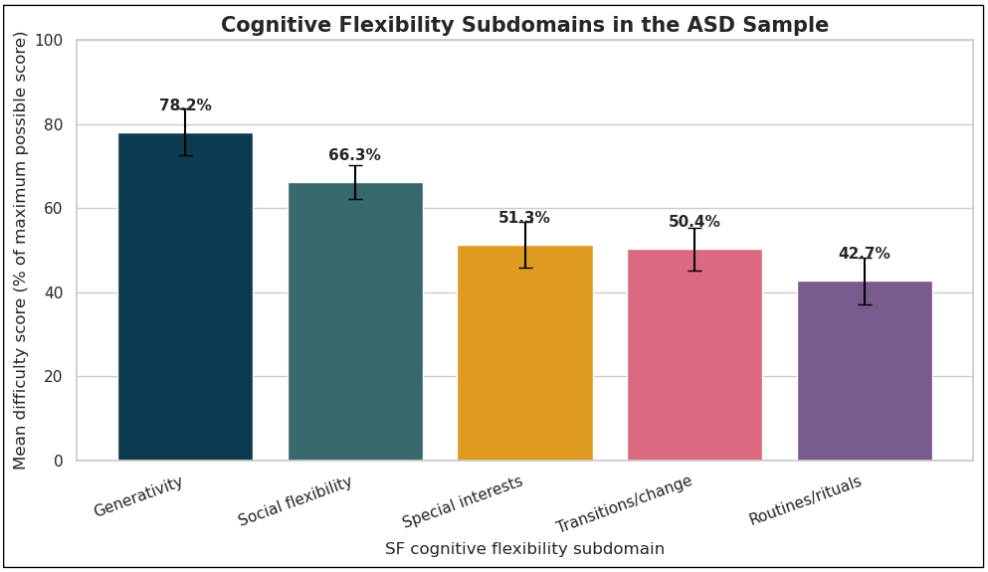


Figure 2. Cognitive Flexibility Subdomains in the ASD Sample

Discussions

Taken together, the results indicate that executive-function difficulties were more consistently related to externalizing than to internalizing or emotional difficulties in our sample. Hyperactivity and the externalizing-problems composite were significantly associated with every CHEXI dimension, whereas emotional problems were related only to working memory and internalizing problems showed weaker, less consistent associations. This pattern suggests that the behavioral manifestations represented by hyperactivity, conduct difficulties, and externalizing

problems may be particularly closely linked to difficulties in inhibitory control and behavioral regulation.

The inhibition-related measures appeared especially relevant. Inhibition and the inhibition index showed the strongest associations with conduct problems and externalizing problems, and the inhibition index also produced the largest CHEXI correlation with hyperactivity. These results are consistent with the interpretation that difficulty suppressing impulsive or contextually inappropriate responses may accompany disruptive and hyperactive behavior. Nevertheless, the cross-sectional correlational design does not establish whether executive-function difficulties contribute to behavioral problems, whether behavioral difficulties interfere with executive functioning, or whether both are influenced by shared developmental, clinical, family, or environmental factors.

The negative correlations with prosocial behavior provide a complementary finding. Participants with higher CHEXI difficulty scores generally had lower prosocial-behavior scores, with the strongest relationship involving behavior regulation. Effective regulation of behavior may facilitate cooperation, consideration of others, and context-appropriate social responding. However, this interpretation remains tentative because prosocial behavior may also be influenced by social opportunities, communication ability, symptom severity, and informant perceptions that were not evaluated by the correlation analysis.

The comparatively weak associations involving emotional and internalizing problems suggest that these difficulties may have a less direct relationship with the CHEXI dimensions in this sample. Alternatively, the pattern may reflect differences in symptom visibility or measurement. Hyperactive and externalizing behaviors are often directly observable, whereas internalizing and emotional difficulties may be less apparent to an external informant. Future analyses could examine whether the findings are replicated across self-report, parent-report, teacher-report, and clinical measures.

The findings should be interpreted with several statistical considerations in mind. First, a relatively large number of correlations were tested, which increases the probability of obtaining some significant results by chance. The smaller correlations with p values close to .05 should therefore be interpreted cautiously, particularly because no correction for multiple comparisons was applied. Second, correlations indicate the strength and direction of associations but do not demonstrate causality. Despite these limitations, the overall pattern consistently highlights hyperactivity, externalizing problems, inhibitory control, and behavioral regulation as the most closely interconnected domains in our sample.

In regard to cognitive flexibility, the findings indicate that SF difficulties were meaningfully associated with behavioral, emotional, and social adjustment. However, the pattern differed across the individual SF dimensions. Transition and routine difficulties showed relatively broad associations with SDQ problems, whereas special interests, social flexibility, and generativity displayed more selective

relationships. The SF total score captured the broadest pattern and was significantly related to all SDQ domains.

Social functioning emerged as a particularly important correlate. Peer problems were associated with every SF dimension, although the relationship with routines, transitions, special interests, generativity, and the SF total score was stronger than the relationship with social flexibility. Prosocial behavior was negatively associated with routines, transitions, social flexibility, generativity, and the SF total score. The largest negative associations involved generativity and the total SF score. This pattern suggests that greater difficulty generating flexible responses and adapting behavior across social contexts may accompany lower levels of cooperative, considerate, and socially responsive behavior.

The results also point to a notable relationship between SF difficulties and internalizing problems. Transition difficulties had the strongest individual SF association with internalization, while routines and the SF total score were also significantly related to internalizing symptoms. Difficulty coping with changes may be accompanied by uncertainty, distress, or reduced predictability, which could contribute to emotional and peer-related difficulties. Internalizing symptoms may also make transitions more challenging, or both may reflect shared clinical and environmental influences.

Associations with externalizing functioning were generally smaller and less consistent at the subscale level. Routines and transitions were related to both conduct and externalizing problems, whereas social flexibility, generativity, and special interests were not significantly associated with the externalization composite. Hyperactivity was significantly related to transitions and generativity but not to routines, special interests, or social flexibility. These results suggest that SF difficulties in this group may be more strongly connected to social and internalizing functioning than to disruptive behavior, although the SF total score retained significant associations with both internalizing and externalizing problems.

Several limitations should be considered. Many correlations were examined, increasing the possibility of chance findings, particularly for coefficients marked only at $p < .05$. The strongest and most consistent associations should therefore receive greater interpretive weight than isolated small correlations. Finally, these findings are correlational and cannot demonstrate causal relationships. Longitudinal research and analyses controlling for age, symptom severity, cognitive ability, and informant effects would be needed to clarify the direction and independence of the observed associations.

The simultaneous regression analyses indicated that SF difficulties were most informative for understanding prosocial behavior, peer problems, and internalizing problems in the ASD group. The five SF dimensions jointly explained approximately 36% of the variance in prosocial behavior, 27% in peer problems, and 26% in internalizing problems. In contrast, the models predicting conduct problems, hyperactivity/inattention, emotional problems, and externalizing problems were not

statistically significant. Overall, this pattern suggests that SF difficulties may be more closely associated with social and internalizing functioning than with externalizing behavior.

The prosocial-behavior model explained the largest proportion of variance. Social flexibility and generativity were the only significant unique predictors in this model. Higher difficulty scores in social flexibility and generativity were associated with lower prosocial-behavior scores after controlling for routines, transitions, special interests, and the other respective SF dimension. Because lower SDQ prosocial scores reflect greater difficulty, these findings suggest that difficulties adapting behavior to changing social situations and generating alternative responses may be associated with poorer prosocial functioning. Prosocial interactions often require individuals to interpret changing social cues, consider different possible responses, and modify their behavior when an initial approach is ineffective. Difficulties in social flexibility and generativity may therefore affect behaviors such as cooperating, helping, sharing, and responding appropriately to others.

The five SF dimensions also jointly explained a significant proportion of the variance in peer problems. However, none of the individual predictors reached conventional statistical significance after accounting for the other SF dimensions. Transitions approached significance, as did generativity, but these findings should not be described as statistically significant. The significant overall model in the absence of significant individual predictors may indicate that the dimensions contribute collectively to peer difficulties or that their shared variance makes their unique effects more difficult to distinguish. Successful peer interactions may require several related abilities, including coping with changes in activities, producing alternative responses, and adapting behavior to social feedback. Peer problems may therefore be more strongly associated with the combined pattern of SF difficulties than with any single dimension.

Transition difficulties were particularly relevant to internalizing problems. After accounting for the other SF dimensions, transitions was the only significant unique predictor of internalizing problems. Greater difficulty managing changes and transitions was associated with higher levels of internalizing difficulties. This finding suggests that problems adjusting to change, shifting between situations, and coping with unpredictability may be relevant to emotional distress. Individuals who experience transitions as unpredictable or difficult may encounter increased uncertainty, worry, or emotional arousal, which could contribute to broader internalizing problems.

Transitions also significantly predicted emotional problems at the individual-predictor level. However, the overall emotional-problems model only approached significance and did not meet the conventional threshold of $p < .05$. The coefficient for transitions should therefore be interpreted cautiously. Although the result is consistent with a possible relationship between transition difficulties and emotional symptoms, it does not provide strong evidence that the five SF dimensions

collectively predict emotional problems. Replication in a larger sample is needed before drawing firm conclusions about this association.

The models predicting conduct problems, hyperactivity/inattention, and externalizing problems were not statistically significant, and none of the SF dimensions made a significant unique contribution to these outcomes. Although transitions had the largest standardized coefficient in the conduct-problems and externalizing-problems models, these coefficients were not statistically significant and should not be interpreted as evidence of an independent association. The nonsignificant findings may suggest that SF difficulties are less directly related to broad behavioral dysregulation than to social and internalizing functioning. Conduct, hyperactivity, and externalizing problems may instead be more strongly influenced by factors not included in the present models, such as impulsivity, inhibitory control, attentional regulation, emotional regulation, or environmental demands.

Special interests did not uniquely predict any of the SDQ outcomes after the other SF dimensions were controlled. Routines also did not make a significant unique contribution to any outcome. These results do not necessarily indicate that routines and special interests are unrelated to emotional or behavioral functioning. Rather, their zero-order relationships with some SDQ outcomes may overlap with the variance explained by transition difficulties or other SF dimensions. Thus, when all five dimensions were considered simultaneously, routines and special interests did not explain additional variance beyond that shared with the remaining predictors.

Several limitations should be considered when interpreting these findings. First, the cross-sectional and correlational design does not permit causal or directional conclusions. SF difficulties may contribute to social and internalizing problems, but emotional distress and repeated negative social experiences could also increase rigidity, resistance to change, or difficulty generating alternative responses. Longitudinal research is necessary to clarify the direction of these relationships. Second, the modest sample size may have limited statistical power to detect unique effects in models containing five correlated predictors. This is particularly relevant to the peer-problems model, in which transitions and generativity approached but did not reach significance. Third, if the SF and SDQ measures were completed by the same informant, shared-method variance may have increased some of the observed relationships. Finally, because the present regression results were reconstructed from correlations rounded to three decimal places, they may differ slightly from analyses conducted using the original participant-level data.

Despite these limitations, the results may have implications for assessment and intervention. Assessing transition difficulties, social flexibility, and generativity may provide useful information about social and internalizing functioning in autistic individuals. Supports aimed at preparing individuals for change, increasing tolerance of unpredictability, generating alternative responses, and adapting behavior to changing social cues may be relevant to their emotional and social needs. However,

intervention research is needed before concluding that targeting these SF dimensions will directly improve SDQ outcomes.

Overall, the findings support examining the distinct dimensions of SF rather than relying exclusively on a total flexibility score. The five SF dimensions were not equally associated with all SDQ outcomes. Transition difficulties were uniquely associated with internalizing problems and showed a significant coefficient in the nonsignificant emotional-problems model, whereas social flexibility and generativity were uniquely associated with prosocial behavior. Peer problems were predicted by the five dimensions collectively, but no single dimension made a statistically significant unique contribution. These findings provide preliminary evidence that different aspects of SF may have distinct relationships with social and emotional functioning in the ASD group.

Limitations and Suggestions for Future Research

In our study, we identified a few limitations. The relatively modest sample size ($N = 59$) limited statistical power to detect small-to-medium effect sizes, particularly for correlations below $r = .30$. As such, non-significant findings, including those approaching conventional significance thresholds, should be interpreted with caution, as the study may have lacked sufficient power to detect true but modest associations among variables. On the other hand, the measurements were based exclusively on teachers' assessments, which may increase the degree of subjectivity and may omit certain aspects related to the child's actual level of performance. Another limitation is the absence of a comparison group that includes typically developing participants, which limits the possibility of directly comparing profiles. At the same time, the reported professional experience of many respondents was relatively limited; around 70% of them had less than three years of experience working with children with ASD, a factor that may influence how the behaviors in question are observed and interpreted and increase the variability of the responses provided. Replication with larger samples, the inclusion of direct cognitive assessments, as well as control groups in future studies could help verify the stability of the obtained results and clarify the mechanisms explaining the relationship between cognitive flexibility, executive functioning, and socio-emotional and behavioral difficulties in children with ASD.

Given that all measures were completed by teachers, the findings may be subject to informant bias, as teacher-report is inherently shaped by the specific behaviors observed within the classroom context and may not fully capture the child's functioning across other settings. Future studies would benefit from incorporating multi-informant approaches (e.g., combining teacher and parent report) to obtain a more comprehensive picture of the child's executive functioning and socio-emotional difficulties across contexts.

A further limitation concerns the internal consistency of the SDQ Total Difficulties scale, which was lower than conventionally expected (α = .580). While the original validation studies of the SDQ have generally reported adequate to good internal consistency for the Total Difficulties score (mean Cronbach's alpha of .73 across a nationwide epidemiological sample) (Goodman, 2001), reliability estimates for this scale vary considerably across samples and populations, with some studies reporting coefficients in a similar or even lower range (0.53–0.86 across age groups in a large Dutch normative sample) (Maurice-Stam et al., 2018). This variability may reflect differences in sample characteristics (e.g., age range, informant type, cultural context) or in the heterogeneity of the difficulties captured by the composite score, which aggregates conceptually distinct subdomains that may not always covary strongly within a given sample. The relatively low alpha observed in the present study should therefore be interpreted with caution, as it may have attenuated the true associations between the social and emotional difficulties and flexibility, potentially leading to an underestimation of effect sizes.

Moreover, another limitation of this study is that participants' medication status and any concurrent interventions (e.g., behavioral, educational, or pharmacological) were not systematically recorded and therefore could not be used as inclusion/exclusion criteria or controlled for in the analyses. Given that psychotropic medication and other concurrent interventions can influence behavioral and cognitive outcomes, it is possible that unmeasured variability in these factors contributed to the results observed. Future research should systematically document participants' medication and intervention history to allow this potential confound to be examined or controlled for.

Although age was examined as a continuous variable in this study, we were unable to conduct meaningful subgroup comparisons between children and early adolescents due to the uneven distribution of participants across the age range, with relatively few participants at the youngest and oldest ends of the range. Future studies with larger, more age-balanced samples are needed to examine whether distinct developmental patterns emerge between childhood and early adolescence, as prior literature suggests notable developmental shifts in both executive function and socio-emotional functioning during this transition.

Implications for educators, clinicians and parents

The present findings suggest that interventions targeting inhibitory control and behavioral regulation may be particularly valuable for reducing externalizing symptoms and hyperactivity in autistic children, given the strong and consistent associations observed between these executive-function domains and both conduct problems and hyperactivity. Structured executive-function interventions with demonstrated relevance for autism, which explicitly targets cognitive flexibility and goal-directed behavior, may represent a suitable framework for clinical adaptation.

Similarly, given the robust association between transition-related difficulty and both internalizing problems and emotional symptoms, clinicians working with autistic children presenting with anxiety or emotional dysregulation should consider systematically assessing difficulty with transitions and unexpected change as a potential contributing factor, incorporating transition-focused strategies (e.g., graduated exposure to change, structured predictability routines) into individualized treatment planning.

Because behavioral-regulation and transition-related difficulties were consistently linked to peer problems and reduced prosocial behavior, classroom-based supports that reduce the executive burden of unpredictability, such as visual schedules, advance warning of transitions, and structured routines, may help mitigate downstream social difficulties rather than addressing peer problems only through direct social-skills instruction. Teachers may also benefit from training to recognize that apparent social withdrawal or peer conflict in autistic students can, in some cases, reflect underlying executive-function or flexibility difficulties rather than a primary social-skills deficit, which has direct implications for how support is prioritized and delivered in inclusive classroom settings.

The associations observed between generativity (the ability to generate flexible, novel responses) and both peer problems and reduced prosocial behavior suggest that parent-mediated interventions encouraging flexible problem-solving in everyday social situations, rather than reliance on scripted or routine responses, may support socio-emotional development at home. Parent-training programs that incorporate explicit coaching in flexible thinking and transition management (e.g., previewing changes to routines, collaboratively generating alternative responses to unexpected situations) may complement clinic- or school-based interventions and extend their impact into the home environment.

Taken together, these findings point toward a shared underlying mechanism, difficulty with cognitive and behavioral flexibility, as manifested through both classic executive-function measures (working memory, inhibition, behavior regulation) and everyday social-flexibility challenges (transitions, generativity), that may benefit from coordinated intervention across clinical, educational, and home settings rather than domain-specific approaches applied in isolation.

Conclusion

This study examined executive functioning, cognitive/behavioral flexibility, and their relationship to socio-emotional and behavioral difficulties in a sample of 59 school-aged children with ASD. The findings indicate that children in this sample displayed elevated difficulties across all domains assessed, executive functioning, behavioral flexibility, and socio-emotional/behavioral functioning, relative to

comparison samples reported in the literature, with particularly pronounced difficulties in working memory, inhibition, peer relationships, and prosocial behavior. Correlational analyses revealed that executive-functioning difficulties, especially those related to inhibitory control and behavioral regulation, were most strongly associated with externalizing and hyperactive behaviors, while cognitive flexibility difficulties, particularly in transitions/change and generativity, were more closely linked to internalizing problems, peer difficulties, and reduced prosocial behavior. Regression analyses further showed that the five flexibility dimensions jointly accounted for meaningful proportions of variance in prosocial behavior, peer problems, and internalizing problems, with transition difficulties emerging as the most consistent independent predictor across models. No significant association was found between children's age and overall flexibility difficulties, suggesting that these difficulties remain relatively stable across the age range studied. Taken together, these results underscore the multidimensional and interconnected nature of executive and flexibility-related difficulties in ASD and highlight social flexibility, generativity, and adaptation to transitions as particularly important targets for intervention aimed at improving peer relationships and prosocial engagement. Given the cross-sectional, correlational design and the reliance on informant-based measures, these conclusions should be considered preliminary; longitudinal studies incorporating direct cognitive assessments and typically developing comparison groups are needed to clarify the direction and mechanisms underlying these associations.

These findings underscore the potential value of integrating executive-function and cognitive-flexibility training into multidisciplinary support plans for autistic children, with particular attention to inhibitory control and transition-related difficulties given their broad associations with both behavioral and emotional outcomes. Coordinated efforts among clinicians, educators, and parents to reinforce flexible thinking and predictable structuring of routines and transitions may offer a practical, evidence-informed pathway for reducing socio-emotional difficulties in this population.

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