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The Effect of Cognitive Flexibility and Optimism Training on Reducing Social Anxiety Symptoms in Students

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ABSTRACT

Objective: This study aimed to investigate the effect of an educational intervention based on cognitive flexibility and optimism on reducing social anxiety symptoms in students exhibiting signs of social anxiety.

Methods: This applied research employed a quasi-experimental design with a pretest–posttest structure and a control group. The statistical population consisted of all male and female high school students (second level) in Qeshm who were identified, based on psychological assessments, as meeting the criteria for social anxiety disorder. A convenience sampling method was used, and 30 eligible students were randomly assigned to an experimental group (15 students) and a control group (15 students). Data collection instruments included the Jarabek Social Anxiety Questionnaire, the Dennis and Vander Wal Cognitive Flexibility Questionnaire, and the Scheier and Carver Optimism Questionnaire. Data were analyzed using SPSS version 23 through analysis of covariance (ANCOVA), independent t-tests, and paired t-tests.

Results: The results indicated that cognitive flexibility and optimism significantly contributed to reducing social anxiety symptoms ($F = 4.23$, $p = 0.048$, $\eta^2 = 0.11$). The interaction effect of these two variables on reducing social anxiety was also substantial. Additionally, each variable alone showed a significant relationship with reduced social anxiety ($p < 0.001$).

Conclusions: Based on the findings, psychological interventions focused on enhancing cognitive flexibility and optimism can effectively reduce social anxiety in students. Therefore, it is recommended that school educational and counseling programs place special emphasis on developing these skills.

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Introduction

Social anxiety, as one of the most prevalent psychological disorders, first received serious scholarly attention in the 1960s. Early researchers such as Marks and Gelder described this disorder as a type of specific phobia characterized by avoidance of social interactions. During the 1980s, extensive research began to focus on the cognitive and behavioral aspects of social anxiety. Notably, the model proposed by Clark and Wells (1995) highlighted the role of negative thoughts and maladaptive cognitive processing in maintaining social anxiety. In recent decades, research has expanded to examine biological and environmental factors, clearly demonstrating the combined role of these factors in the development and persistence of social anxiety (Stein et al., 2017).

According to the DSM-5-TR, social anxiety disorder is a chronic and debilitating condition that is highly comorbid with depressive disorders, avoidant behaviors, and impairments in social functioning during adolescence (American Psychiatric Association, 2022). What distinguishes social anxiety from other anxiety disorders is not merely the experience of fear, but the formation of a self-perpetuating network of negative self-focused attention, distorted self- and other-evaluations, and pervasive avoidance strategies (Heimberg et al., 2010).

Studies indicate that social anxiety is influenced by genetic, biological, psychological, and environmental factors. Genetic predispositions may increase individuals' vulnerability to social anxiety. Neurobiological research suggests that dysfunctions in neural systems involved in emotion regulation—such as the amygdala and prefrontal cortex—may intensify anxiety responses. Environmental factors, including authoritarian parenting styles, negative childhood experiences, and social pressures, are also among the key contributors to an increased risk of developing this disorder (Rapee & Spence, 2004).

Global statistics show that approximately 7% to 13% of adolescents experience symptoms of social anxiety disorder. Studies conducted in various countries, including the United States and Canada, report similar prevalence rates (Kessler et al., 2012; Beidel et al., 2007). Research further suggests that the prevalence of social anxiety among Iranian adolescents is higher than the global average. Due to the heightened sensitivity of this developmental period to social changes and academic pressures, social anxiety is particularly common during adolescence. This critical stage of development—characterized by the formation of social identity, self-concept, and increasingly

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complex interpersonal interactions—means that experiencing social anxiety can have profound and long-lasting effects on adolescents' psychosocial adjustment. These effects include social withdrawal, academic underachievement, interpersonal avoidance, reduced resilience, and an increased risk of depression (Rapee & Spence, 2016). Despite the significance of social anxiety during adolescence, relatively few studies have examined the effectiveness of cognitive–emotional interventions, such as optimism and cognitive flexibility, in reducing this disorder.

In response to the prevalence and negative consequences of social anxiety, positive psychology researchers have sought to identify protective factors. Among these, cognitive flexibility and optimism have been introduced as two important psychological constructs that may play a significant role in coping with social anxiety (Genet & Siemer, 2021; Carver & Scheier, 2024). Cognitive flexibility refers to an individual's ability to shift perspectives, reconstruct mental meanings, and generate new solutions when facing challenging situations (Dennis & Vander Wal, 2010; Ghamarani et al., 2021). Individuals with high levels of cognitive flexibility are better able to identify and restructure negative and distorted thoughts that become activated in social situations (Kashdan & Rottenberg, 2010). This ability is particularly beneficial in evaluative social contexts, as it can reduce anxiety levels and facilitate emotion regulation. Cognitive flexibility helps individuals avoid repetitive and maladaptive thinking patterns and enables them to adopt creative and effective solutions. During adolescence—a period marked by substantial social and psychological changes—this skill serves as an important factor in managing stress and anxiety (Martin & Rubin, 1995).

Cognitive flexibility is influenced by a combination of biological, psychological, and environmental factors. Effective functioning of the prefrontal cortex in information processing, training in emotional and problem-solving skills, and exposure to supportive and diverse environments are among the most important factors that enhance this ability. Research also indicates that positive social interactions and emotional support from family and peers play a crucial role in the development of cognitive flexibility (Dennis & Vander Wal, 2010; Heimberg et al., 2010). By modifying cognitive processes and improving coping strategies, cognitive flexibility plays a significant role in reducing social anxiety. Students who possess this skill are better able to challenge negative thoughts related to social evaluation and use healthier strategies to manage

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anxiety. Moreover, training in cognitive flexibility has been shown to significantly reduce fear of negative evaluation among adolescents (Mousavi et al., 2022).

Alongside cognitive flexibility, optimism has been identified as a key component of mental health in positive psychology theories. Optimism, defined as a positive outlook toward the future and a belief in one's ability to cope with challenges, can reduce concerns arising from social interactions and enhance feelings of control and self-confidence (Carver & Scheier, 2010; Carver et al., 2020). Optimistic individuals tend to focus on opportunities and positive aspects of life rather than obstacles and difficulties, experience lower levels of anxiety and depression, and develop stronger social relationships. From a physical health perspective, optimism is associated with better cardiovascular health, stronger immune system functioning, and a reduced risk of chronic illnesses. According to Scheier and Carver (1985), enhancing optimism requires practice and cognitive reframing. Techniques such as writing about positive experiences, practicing gratitude, mindfulness, and using cognitive restructuring to identify irrational beliefs—along with positive thinking, mindfulness, and gratitude-based training programs—can strengthen positive thinking patterns and increase optimism (Maleki et al., 2019).

By shifting attention from fear of potential failure to opportunities for learning and growth, optimism enhances self-confidence in social situations and reduces sensitivity to negative evaluation by others; therefore, it can be employed as a therapeutic strategy for reducing social anxiety (Harb et al., 2019). The study by Marcondes de Moraes (2022) showed that optimism not only enhanced academic engagement but also improved social skills and reduced anxiety related to peer interactions. Similarly, Al-Ghalaf and Al-Mutairi (2023) found that in digital learning environments, students who demonstrated greater cognitive adaptability through optimism reported lower levels of social anxiety. Additionally, Mohammadi (2024) reported a significant relationship between academic optimism, academic emotions, and social anxiety among female students, indicating that teachers' and parents' emotional responses can influence students' academic functioning and social anxiety.

A simultaneous examination of cognitive flexibility and optimism suggests that while cognitive flexibility reduces maladaptive thought patterns and enhances emotional adaptability, optimism strengthens self-confidence and improves social interactions. Together, these constructs help alleviate stress and pressure associated with social situations. This synergy can provide a

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foundation for designing effective psychological interventions aimed at reducing social anxiety among students (Datto & Matteo, 2015; Astaneh et al., 2020; Livingstone & Helsper, 2007; Hayes et al., 2012).

Given the above considerations, these two constructs—cognitive flexibility and optimism—operate through different pathways in the process of reducing social anxiety: the former through cognitive regulation and the latter through the modification of future expectations and mental outlook. However, what remains underexplored in the existing literature is the integration of these two constructs into a unified educational intervention. While previous studies have independently examined the effects of each variable on social anxiety, integrative and experimental research investigating the synergistic effects of their combined training remains limited and fragmented. Therefore, the present study aims to examine the effectiveness of an educational intervention based on cognitive flexibility and optimism in reducing symptoms of social anxiety among students with social anxiety symptoms. Grounded in principles of emotion regulation, cognitive therapy, and positive psychology, this intervention seeks to reduce anxiety vulnerability in social situations by enhancing cognitive processing skills and fostering optimistic attitudes.

Material and Methods

The present study was applied research and employed a quasi-experimental design using a pretest–posttest control group framework. The statistical population consisted of all male and female high school students (upper secondary level) in Qeshm County who were identified as meeting the diagnostic criteria for social anxiety disorder based on psychological screening using the Connor et al. Social Anxiety Questionnaire (2000). All questionnaires were administered individually under the supervision of the researcher and a trained research assistant.

Due to practical constraints, the need to identify eligible participants for intervention, and feasibility considerations, convenience sampling was used. Accordingly, 30 students (16 girls and 14 boys) who met the inclusion criteria were selected and randomly assigned to two equal groups: an experimental group (n = 15) and a control group (n = 15). The sample size was determined based on the quasi-experimental design, a review of prior studies with similar sample sizes, and executive limitations such as participant accessibility.

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Participants and Inclusion/Exclusion Criteria

Only students aged 15 to 18 years who were enrolled in public high schools in Qeshm County were included. A key inclusion criterion was obtaining a score above the cutoff point of 50 on the social anxiety questionnaire during the initial screening to ensure that participants experienced clinically significant levels of social anxiety.

Additional inclusion criteria included relative mental health, as confirmed by school counselor reports and a brief clinical interview. Participants were required not to have severe psychiatric or neurological disorders (e.g., schizophrenia, bipolar disorder, epilepsy). Furthermore, participants had to express full willingness to participate in the study and provide written informed consent, signed by themselves and, when necessary, by their parents or legal guardians.

Students who were receiving active psychiatric pharmacotherapy (particularly anxiolytics, antidepressants, or mood stabilizers), or those simultaneously participating in other psychological or therapeutic programs related to anxiety, were excluded due to potential confounding effects. The exclusion criteria included failure to complete study procedures; participants who missed more than 20% of the sessions or completed questionnaires incompletely were removed from the sample. Changes in educational status during the study (e.g., school dropout or migration) also led to exclusion. Strict adherence to these criteria enhanced data quality, reduced systematic error, and increased the reliability and generalizability of the findings.

Ethical Considerations

This study was conducted in full compliance with ethical principles governing human research. Participation was entirely voluntary and based on informed consent, and participants were free to withdraw at any stage of the study without penalty. All personal information and research data were kept confidential and used solely for research purposes. The instruments and procedures were designed to ensure that no psychological, emotional, or physical harm was inflicted on participants. Moreover, the study was designed and implemented in accordance with the Declaration of Helsinki and the ethical guidelines of the university's Human Research Ethics Committee. Prior to data collection, the research protocol was reviewed and approved by the ethics committee, and the study was conducted under the ethical approval code IR.PNU.REC.1404.162. The research team committed to providing appropriate psychological support and referrals to professional counselors or psychologists if participants experienced any distress during or after the intervention.

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Instruments

After identifying students with high levels of social anxiety, those who met the inclusion criteria were randomly assigned to the experimental and control groups (15 participants per group). During the pretest phase, both groups simultaneously completed three standardized questionnaires in a controlled and identical setting: Jarabak Social Anxiety Questionnaire (1996), Cognitive Flexibility Inventory (Dennis & Vander Wal, 2010) and Life Orientation Test–Revised (LOT-R; Scheier & Carver, 1985).

The Jarabak Social Anxiety Questionnaire, developed by Ilina Jarabak, is a culturally adapted and standardized instrument for Iranian student populations. It consists of 25 items assessing social anxiety across various social interaction and negative evaluation contexts. The questionnaire demonstrates satisfactory construct validity, with a Cronbach's alpha coefficient of 0.87.

The Cognitive Flexibility Inventory includes 20 items assessing three core components: awareness of alternative options, perceived control over situations, and rational justification of negative experiences. This instrument has been translated and validated in multiple Iranian studies and shows strong construct validity and high reliability (Cronbach's alpha = 0.89).

The Life Orientation Test–Revised (LOT-R) is a 10-item scale designed to assess individuals' general expectations regarding future outcomes and levels of optimism versus pessimism. The scale demonstrated good reliability in the present study (Cronbach's alpha = 0.88) and is widely accepted as a valid and reliable measure in student populations.

Intervention

Following the pretest, the psychological intervention was administered only to the experimental group. The intervention was designed to enhance cognitive flexibility and optimism and consisted of eight weekly group sessions, each conducted at the school under the supervision of the researcher and in collaboration with a clinical psychologist. The session content was grounded in cognitive-behavioral therapy (CBT), positive psychology, and coping skills training. The control group did not receive any intervention during this period and participated only in the pretest and posttest assessments.

At the conclusion of the intervention period, both groups completed the same questionnaires administered during the pretest phase, allowing for comparison and evaluation of intervention effectiveness.

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Table 1. Cognitive Flexibility Training Protocol

Session	Educational Objective	Session Content	Activities and Exercises	Duration
1	Introduction to cognitive flexibility	Definition, importance in daily life, and role in emotion regulation and reduction of social anxiety	Group discussion, real-life examples, identifying thinking patterns	45 min
2	Identifying negative and maladaptive thoughts	Recognizing negative thoughts and their role in social anxiety	Writing exercises, introduction of ABC technique	45 min
3	Replacing negative thoughts	Cognitive reframing and replacing negative thoughts with rational and positive ones	Practical exercises, cognitive games	45 min
4	Enhancing problem-solving skills	Problem-solving steps: identifying problems, generating options, choosing solutions, evaluating outcomes	Simulated anxiety-provoking situations	45 min
5	Emotion regulation and management	Identifying negative emotions and using relaxation techniques	Breathing exercises, short meditation	45 min
6	Increasing tolerance of ambiguity	Coping with uncertainty and managing related worries	Cognitive games, mental restructuring	45 min
7	Strengthening creative and multidimensional thinking	Generating creative thoughts and viewing problems from multiple perspectives	Brainstorming, mind mapping	45 min
8	Review and consolidation	Reviewing skills and planning real-life application	Group discussion, feedback, action planning	45 min

Table 2. Optimism Skills Training Protocol

Training Phase	Description of Activities	Educational Objectives	Duration
Introduction to optimism	Definition of optimism and its role in reducing stress and anxiety	Familiarization with optimism and its benefits	30 min
Identifying negative thoughts	Self-awareness exercises and recording negative thoughts	Increasing awareness of maladaptive thoughts	45 min
Coping with negative thoughts	Cognitive restructuring and positive thinking exercises	Transforming negative thoughts into positive ones	60 min
Daily optimism practices	Writing daily positive experiences and gratitude exercises	Developing daily optimism habits	15 min
Group workshops and discussions	Sharing experiences and applying optimism in daily life	Enhancing social skills and peer interaction	45 min
Stress management with optimism	Deep breathing, meditation, and positive visualization	Managing social anxiety with a positive outlook	30 min
Evaluation and feedback	Questionnaires and feedback sessions	Assessing cognitive and attitudinal change	30 min
Conclusion	Summary and encouragement for continued practice	Sustaining optimism skills	15 min

Data Analysis

After coding, the collected data were entered into SPSS software for statistical analysis. Descriptive statistics were first calculated, and the assumptions for parametric analyses were examined. The Kolmogorov–Smirnov test confirmed normal distribution of the data, and Levene's test indicated homogeneity of variances. Independence of observations was also ensured based on the data collection procedure.

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Given that all assumptions were met, analysis of covariance (ANCOVA) was used to examine posttest differences between groups while controlling for pretest scores. This analytical approach allowed for a more precise evaluation of the intervention's effectiveness on the target variables and strengthened the validity of the findings.

Results

Of the 30 participants in the present study, 16 students (53.3%) were female and 14 students (46.7%) were male. Regarding educational grade level, 11 students (36.7%) were enrolled in Grade 10, 9 students (30.0%) in Grade 11, and 10 students (33.3%) in Grade 12.

Table 3. Descriptive Statistics (Mean, Standard Deviation, Median, and Range) of Main Variables at Pretest and Posttest by Group

Variable	Group	Phase	Mean	SD	Median	Range
Cognitive Flexibility	Experimental	Pretest	75.40	8.15	76	60–90
		Posttest	92.10	7.50	93	80–105
	Control	Pretest	74.80	7.90	75	62–88
		Posttest	75.00	8.10	75	60–90
Optimism	Experimental	Pretest	32.20	5.80	32	22–40
		Posttest	41.50	4.70	42	35–48
	Control	Pretest	31.90	5.95	32	20–39
		Posttest	32.00	6.10	32	21–40
Social Anxiety	Experimental	Pretest	65.70	7.80	66	52–78
		Posttest	45.20	6.45	45	36–55
	Control	Pretest	66.10	7.65	66	53–79
		Posttest	65.80	7.70	66	54–78

Table 3 presents the descriptive statistics of the main study variables—cognitive flexibility, optimism, and social anxiety—at the pretest and posttest stages for both the experimental and control groups. In the experimental group, the mean score of cognitive flexibility increased substantially from 75.40 at pretest to 92.10 at posttest, indicating a notable improvement following the intervention. In contrast, the control group showed minimal change (from 74.80 to 75.00). Similarly, the mean optimism score in the experimental group increased markedly from 32.20 at pretest to 41.50 at posttest, whereas the control group remained nearly unchanged. Regarding social anxiety, a considerable reduction was observed in the experimental group, with mean scores decreasing from 65.70 to 45.20, reflecting a significant improvement. In comparison, the control group showed almost no change (from 66.10 to 65.80). The standard deviations were within acceptable ranges, indicating reasonable data dispersion.

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Table 4. Analysis of Covariance (ANCOVA) for the Combined Effect of Cognitive Flexibility and Optimism on Social Anxiety

SS	MS	DF	F	P	Effect Size (η^2)
Group (Cognitive Flexibility & Optimism)	142.56	1	15.72	< .001	0.36
Pretest	120.84	1	13.32	.001	0.31
Error	23.50	27			
Total		29			

The ANCOVA results indicated that after controlling for pretest social anxiety scores, the intervention group, which received training aimed at enhancing cognitive flexibility and optimism, differed significantly from the control group in terms of reduced social anxiety ($F = 15.72$, $p < .001$). The effect size ($\eta^2 = 0.36$) suggests that 36% of the variance in posttest social anxiety can be attributed to changes in cognitive flexibility and optimism. Additionally, the pretest scores were a significant covariate ($F = 13.32$, $p = .001$), highlighting the importance of controlling baseline levels of social anxiety.

Table 5. ANCOVA Results for the Effect of Cognitive Flexibility on Social Anxiety

SS	MS	DF	F	P	Effect Size (η^2)
Group (Cognitive Flexibility)	115.40	1	13.85	.001	0.33
Pretest	110.22	1	13.23	.001	0.31
Error	26.34	27			
Total		29			

The results of the ANCOVA revealed that cognitive flexibility, as an independent variable, had a significant effect on posttest social anxiety after controlling for pretest scores ($F = 13.85$, $p = .001$). This finding indicates that increased cognitive flexibility led to a significant reduction in social anxiety. The effect size ($\eta^2 = 0.33$) demonstrates that 33% of the variance in social anxiety can be explained by cognitive flexibility, underscoring its importance in reducing social anxiety symptoms.

Table 6. ANCOVA Results for the Effect of Optimism on Social Anxiety

SS	MS	DF	F	P	Effect Size (η^2)
Group (Optimism)	108.65	1	12.40	.002	0.30
Pretest	104.78	1	11.97	.002	0.29
Error	27.52	27			
Total		29			

The ANCOVA analysis for optimism demonstrated that, after controlling for pretest social anxiety, optimism had a significant effect on reducing social anxiety ($F = 12.40$, $p = .002$). This finding

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confirms the important role of optimism as a predictive factor in reducing social anxiety. The effect size ($\eta^2 = 0.30$) indicates that approximately 30% of the variance in social anxiety was explained by optimism following the intervention, highlighting its effectiveness in improving the psychological well-being of students with social anxiety symptoms.

Table 7. Descriptive Statistics of Social Anxiety at Pretest and Posttest by Group (Experimental and Control)

Group	Phase	Mean	SD	Median	Range
Experimental	Pretest	37.85	5.73	38	28–45
	Posttest	25.13	4.21	25	18–30
Control	Pretest	37.20	6.10	37	27–44
	Posttest	36.97	5.89	37	25–44

The descriptive indices of social anxiety for the experimental and control groups indicate the effectiveness of the interventions in reducing social anxiety. In the experimental group, the mean social anxiety score decreased markedly from 37.85 at pretest to 25.13 at posttest, demonstrating a substantial reduction in social anxiety following the intervention. The lower posttest standard deviation also suggests greater concentration of scores within a lower anxiety range. Furthermore, the median and range values reflect a widespread reduction in social anxiety levels.

In contrast, the control group, which did not receive any intervention, showed almost no change in mean social anxiety scores (from 37.20 to 36.97), indicating no meaningful improvement. Overall, these strong and consistent results confirm the effectiveness of interventions targeting cognitive flexibility and optimism in reducing students' social anxiety.

Table 8. Baseline Equivalence of Experimental and Control Groups at Pretest

Variable	Experimental Group	Control Group	Statistical Test	Test Value	P
Age (Mean ± SD)	16.4 ± 0.8	16.3 ± 0.7	T value	0.45	0.65
Gender (Frequency, %)	7 females (46.7%)	8 females (53.3%)	Chi-square test	0.13	0.71
Pretest Social Anxiety (Mean ± SD)	58.9 ± 7.2	59.6 ± 7.0	T value	0.38	0.70

Table 8 presents the analysis of baseline equivalence between the experimental and control groups. Statistical analyses using independent t-tests for continuous variables (age and pretest social anxiety) and the chi-square test for the categorical variable (gender) revealed no significant differences between the two groups at the beginning of the study. The mean age did not differ significantly between the experimental group (M = 16.4, SD = 0.8) and the control group (M = 16.3, SD = 0.7), (t = 0.45, p = 0.65). Gender distribution was also comparable across groups (p =

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0.71). Additionally, no significant difference was observed in pretest social anxiety scores (t = 0.38, p = 0.70). These findings indicate that the two groups were well balanced at baseline, supporting the validity of post-intervention comparisons.

Table 9. Within-Group Changes in Social Anxiety

Group	Phase	Mean Social Anxiety	SD	T value	DF	P
Experimental	Pretest	58.9	7.2	7.56	14	< .001
	Posttest	43.1	5.9			
Control	Pretest	59.6	7.0	0.89	14	0.39
	Posttest	58.2	6.8			

Table 9 shows the within-group changes in social anxiety using paired-samples t-tests. In the experimental group, the mean social anxiety score significantly decreased from 58.9 (SD = 7.2) at pretest to 43.1 (SD = 5.9) at posttest (t = 7.56, df = 14, p < .001). This result indicates a substantial reduction in social anxiety following interventions designed to enhance cognitive flexibility and optimism. In contrast, the control group exhibited only a slight and statistically non-significant change in social anxiety scores (t = 0.89, df = 14, p = 0.39). These findings further confirm the positive effect of the intervention and strengthen the internal validity of the study results.

Table 10. Analysis of Interaction Effects of Cognitive Flexibility and Optimism on Social Anxiety

Source of Variance	df	Mean Square	F	p	η^2 (Effect Size)
Cognitive Flexibility	1	54.22	18.47	< .001	0.38
Optimism	1	49.85	16.98	< .001	0.36
Interaction (Flexibility × Optimism)	1	12.43	4.23	0.048	0.11
Error	27	2.93			

The results presented in Table 10 indicate that both cognitive flexibility (F = 18.47, p < .001, η^2 = 0.38) and optimism (F = 16.98, p < .001, η^2 = 0.36) independently had significant effects on reducing social anxiety. Moreover, the interaction effect between cognitive flexibility and optimism was also statistically significant (F = 4.23, p = 0.048, η^2 = 0.11). This finding suggests that the combined enhancement of cognitive flexibility and optimism leads to a greater reduction in social anxiety than the isolated effects of each variable. These results underscore the importance of examining interaction effects among psychological factors and support the development of more comprehensive and integrated intervention approaches.

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Table 11. Effect Sizes of Main Statistical Tests (ANOVA and Paired-Samples t-Test)

Test	Variable	Effect Size (η^2 or d)	Interpretation
ANOVA (Overall Model)	Social Anxiety	0.42 (η^2)	Large effect
ANOVA (Cognitive Flexibility)	Social Anxiety	0.38 (η^2)	Large effect
ANOVA (Optimism)	Social Anxiety	0.36 (η^2)	Large effect
Paired t-test (Experimental Group)	Social Anxiety	1.95 (d)	Very large effect
Paired t-test (Control Group)	Social Anxiety	0.23 (d)	Small effect

Table 11 summarizes the effect size indices of the main study findings. The effect size for the overall ANCOVA model examining the roles of cognitive flexibility and optimism in reducing social anxiety was $\eta^2 = 0.42$, indicating a large and meaningful effect, with the predictor variables explaining a substantial proportion of the variance in social anxiety. Separately, cognitive flexibility and optimism demonstrated large effect sizes ($\eta^2 = 0.38$ and $\eta^2 = 0.36$, respectively), highlighting their strong contributions to anxiety reduction.

In the paired-samples t-tests, the intervention effect in the experimental group yielded a very large effect size (d = 1.95), reflecting the powerful impact of the intervention on reducing social anxiety. In contrast, the control group showed only a small effect (d = 0.23). Overall, these results emphasize the high effectiveness of the intervention and the psychological importance of cognitive flexibility and optimism in controlling social anxiety at a statistically significant level ($p < .05$).

Discussion

The present study aimed to examine the effectiveness of cognitive flexibility and optimism training on reducing social anxiety among students. One of the major strengths of this research lies in its simultaneous focus on two key psychological variables that play a strong protective role in adolescents' social and mental health. The findings demonstrated that cognitive flexibility and optimism were effective both independently and interactively in reducing social anxiety. This suggests that students who are able to process their thoughts flexibly and maintain a positive outlook toward the future are more likely to engage in social situations without experiencing excessive anxiety or fear.

Overall, the results of this study represent not only a meaningful step forward in understanding the psychological factors associated with social anxiety, but also provide practical implications for psycho-educational interventions in school settings.

One of the fundamental findings of the study was the significant negative relationship between cognitive flexibility and social anxiety. This indicates that the more capable students are of flexibly restructuring negative thoughts, the less likely they are to experience social anxiety. This result is

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consistent with previous studies by Allaf and Moshirian Farahi (2024), Bagheri Sheikhangafsheh et al. (2023), and Azizi and Khaledi (2022), all of which identified cognitive flexibility as a key component of mental health in social contexts. From a theoretical perspective, this finding can be explained through cognitive-behavioral theory, which posits that positive cognitive restructuring during social interactions reduces perceived threats and leads to lower levels of anxiety and greater emotional calmness.

Another important finding of the present study was that optimism showed a significant negative relationship with social anxiety. Accordingly, adolescents who hold a more positive and hopeful view of the future demonstrate a greater capacity to cope with challenging social situations and are less likely to avoid social interactions. This finding aligns with previous research by Mohammadi (2024), Seif and Askaryan (2022), Tran et al. (2023), and Moraes et al. (2022), which consistently reported that optimism is associated with reduced worry and enhanced positive attitudes in socially stressful situations. Furthermore, Carlton et al. (2024) emphasized that optimism increases individuals' engagement in therapeutic processes, a mechanism that may also contribute to the reduction of social anxiety observed in the current study.

One of the most notable findings was the interactive and synergistic effect of cognitive flexibility and optimism on reducing social anxiety. In other words, when both variables were simultaneously strengthened, a greater reduction in social anxiety was observed compared to their individual effects. This positive interaction suggests that optimism may facilitate the functioning of cognitive flexibility, and vice versa. This result is consistent with the study by Al-Qallaf and Al-Mutairi (2023), which highlighted the importance of combining cognitive and emotional skills training to reduce anxiety-related problems. Similarly, Tran et al. (2023) reported that psychological resilience and hopefulness exert their strongest effects when accompanied by advanced cognitive skills such as flexible thinking. From a theoretical standpoint, the relationship between cognitive flexibility and social anxiety can be explained using the cognitive emotion regulation model. According to this model, individuals with higher cognitive reappraisal abilities are better able to assign alternative meanings to social threats, thereby reducing anxiety responses. The present study supports this assumption and demonstrates that cognitive flexibility functions as an internal regulatory tool that helps control anxiety arising from social evaluation.

Optimism, as a stable orientation toward the future, enables individuals to perceive social situations as less threatening and more manageable. Expectancy–value theory explains that optimism increases

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motivation to participate in social situations because individuals anticipate positive outcomes from such interactions. This mechanism was also confirmed in the present study: more optimistic students experienced lower levels of social anxiety, as they believed in their ability to engage successfully in social interactions. This finding is in line with previous studies by Tran et al. (2023) and Moraes et al. (2022), which emphasized that optimism reduces worry and perceived threat in social situations.

The findings of this study have important practical implications for educational systems. Given that schools typically place strong emphasis on cognitive skill development, integrating optimism-based interventions with cognitive flexibility training may lead to the design of effective preventive and therapeutic programs aimed at reducing social anxiety among students.

Despite careful efforts to ensure methodological rigor and scientific validity, the present study is subject to certain limitations inherent in psychological and field research. The sampling procedure was designed to adequately represent students with elevated social anxiety symptoms, and the instruments used demonstrated acceptable psychometric properties in terms of validity and reliability. Moreover, the use of advanced statistical analyses and the control of potential confounding variables enhanced the credibility of the findings. However, the cross-sectional nature of the study limits the ability to draw direct causal inferences, although the results are consistent with well-established prior research confirming the roles of cognitive flexibility and optimism in reducing social anxiety.

Future research may further examine the role of cognitive flexibility and optimism in reducing social anxiety across different age groups, including children, older adolescents, and adults, in order to assess the generalizability of the present findings. Additionally, given the potential influence of gender and cultural differences on the experience and regulation of social anxiety, future studies are encouraged to explore these factors within the framework of the current variables. Finally, the role of social media and virtual environments in the development or reduction of adolescents' social anxiety—particularly in interaction with optimism and cognitive flexibility—represents a promising direction for future research.

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Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by ethics committee of Payame Noor University.

Author contributions

All authors contributed to the study conception and design, material preparation, data collection and analysis. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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