The Effectiveness of Online Interpretation Bias Modification on Coping Strategies in College Students with Type D Personality

Abstract

Background: Individuals with Type D personality typically employ maladaptive coping strategies, particularly in ambiguous situations, which may exacerbate their psychological distress. This study aims to evaluate the effectiveness of online interpretation bias modification intervention on improving coping strategies among college students with Type D personality.

Methods: This study was conducted within a positivist paradigm using a quantitative approach. The target population comprised students from Persian Gulf University. A total of 84 students identified with Type D personality, as measured by Type D Personality Scale, were randomly assigned to either an experimental group or a control group. The Coping Strategy Questionnaire was used to assess coping strategies. The experimental group participated in 10 sessions of an Android application-based interpretation bias modification over a period of 8 weeks. Data were analyzed using SPSS software, version 26.

Results: The results indicate that ten sessions of the online interpretation bias modification significantly improved coping strategies among students with Type D personality ($p < 0.0001$). Specifically, the intervention significantly increased positive adaptation, problem-solving, emotional support seeking, and self-regulation while significantly decreasing withdrawal and disengagement behaviors ($p < 0.0001$).

Conclusion: The study demonstrates that online interpretation bias modification is effective on enhancing coping strategies among Type D personality college students. These findings suggest its potential utility for psychologists and mental health professionals.

Keywords: College Students, Coping Strategies, Interpretation Bias Modification, Online Intervention, Type D Personality

Introduction

Research indicates that 84% of people with Type D personality suffer from at least one psychological disorder (Lambertus et al., 2018), and 25% of coronary heart patients have Type D personality (Kupper & Denollet, 2018). The term "Type D personality" is derived from the first letter of "Distress" (O'Riordan et al., 2023) because this personality type makes a person vulnerable to tension and a pessimistic view toward the world (Ogińska-Bulik & Michalska, 2021). This personality type consists of two problematic components: negative affectivity (NA) and social inhibition (SI). NA refers to an individual's tendency to experience negative emotions, while SI refers to an individual's withdrawal from expressing these emotions due to fear of rejection (Cho et al., 2023). Consequently, individuals with this personality type are likely to employ maladaptive coping strategies when facing challenges, more so than those without this personality type.

Folkman and Lazarus describe coping strategies as the behavioral and psychological responses used to manage, reduce, or tolerate challenging situations (Quynh Ho et al., 2022). Similarly, Sumin et al. (2022) reported that students with Type D personality often lack appropriate coping strategies, frequently resorting to escape-avoidance tactics. Therefore, this study recommended modifying the coping strategies of students with Type D personality.

On the other hand, Sharma & Gupta (2023) reported that negative reappraisal can activate emotion-focused coping strategies, while positive reappraisal can activate problem-focused strategies. Furthermore, negative appraisal can manifest as a cognitive bias, where information is processed unrealistically (Bogie et al., 2020). Thus, the link between cognitive bias and maladaptive coping strategies is clear. Additionally, a research revealed that negative appraisal and coping strategies play a significant role in heart disease among individuals with Type D personality (Lv et al., 2020). Therefore, it is necessary to investigate cognitive bias and coping strategies in this personality type.

One such cognitive bias is interpretation bias, which alters a person's appraisal of ambiguous stimuli. This bias typically leads to the negative processing of information (Chen et al., 2020). Consequently, interventions have been designed to modify this bias. In interpretation bias modification, the individual's appraisal of an ambiguous stimulus is altered (Jones & Sharpe, 2017). Numerous studies have demonstrated that this intervention can reduce psychological problems in emotional disorders, such as depression (Smith et al., 2018), anxiety (Fodor et al., 2020), obsessive-compulsive disorder (Falkenstein et al., 2022), and post-traumatic stress disorder (Hett et al., 2022). Additionally, Li et al. (2023) reported that individuals with Type D personality exhibit high levels of depression and anxiety. Furthermore, another study showed that cognitive biases play a significant role in

decision-making strategies (Acciarini et al., 2020). Yamaguchi et al. (2020) also reported that people with type D personality have less planning and higher responsibility shifting. They emphasize performing coping interventions for this personality type. Similarly, Borkoles et al. (2018) revealed that athletes with type D personality tend to use more maladaptive strategies such as emotion and avoidance coping. Therefore, they suggest that future researchers perform interventions to reduce these people's maladaptive performance, such as their coping strategies. On the other hand, the cognitive-emotional-rational model explains the relationship between stress and coping strategies as a process of the relationship between individuals' internal and external situations. In people with type D personality, the situations tend to be appraised more stressful, and they use more maladaptive coping strategies to face these stresses based on their negative appraisals (Borkoles et al., 2018). Therefore, if their appraisals change, they will probably use different coping strategies that are more appropriate.

With regard to the use of maladaptive coping strategies by individuals with Type D personality (Sumin et al., 2022, Lv et al., 2020, Yamaguchi et al., 2020, Borkoles et al., 2018), the association of this personality type with negative cognitive factors (Lv et al., 2020, Gogheri et al., 2023, Kazukauskiene et al., 2022), the effectiveness of reappraisal on coping strategies (Sharma & Gupta, 2023), as well as the recommendations of previous

studies regarding the implementation of interventions to influence maladaptive coping strategies; cognitive bias modification interventions may prove effective in altering the coping strategies of individuals with Type D personality. It aligns with the definition of personality; cognitive and behavioral factors can exert reciprocal influences on one another (Jong-Hyun et al., 2018), and individuals' appraisal processes may play a significant role in selecting coping strategies (Sharma & Gupta, 2023). However, no prior research has investigated the impact of this intervention on the coping strategies of individuals with Type D personality. Therefore, the present study aims to address this research gap.

Thus, the purpose of the present research is to determine the effectiveness of the online interpretation bias modification, designed specifically for Type D personality by the researchers of this study, on coping strategies in students with Type D personality. Conducting this study can help students with Type D personality apply appropriate coping strategies by modifying their interpretation bias in critical situations.

Methodology

The present study was conducted using a positivistic paradigm and a quantitative approach. The target population consisted of students from Persian Gulf University, encompassing both genders, three educational levels, and various fields of study. The sampling process includes these steps: 1. The students of Persian Gulf University were divided into five

clusters based on the university departments, including humanities, engineering, Sciences, Economics, and Data science. 2. Random sampling was used to select specific classes from all three educational levels in these clusters. 3. The Type D scale was presented to the students from selected classes to identify the students with this personality type 4. Finally, 84 students with type D personality were selected to conduct the intervention sessions. 5. These participants were randomly assigned to either the experimental group (42 people) or the control group (42 people).

The experimental group underwent 10 sessions of online interpretation bias modification, which were designed by the researchers of this study based on previous qualitative research. These sessions were conducted over a period of 8 weeks. Coping strategies were assessed for both groups using pre-test and post-test measures.

The sample size was determined using sample power software, with a power of 60%, a confidence level of 95%, an effect size of 0.25, and a standard error of 1. Due to time and resource limitations as one of the options for determining the sample size (Islam, 2018), achieving a larger sample size was challenging. Therefore, the present study aimed to balance statistical rigor with practical feasibility, and a power of 60% allowed it to proceed with the study without compromising the overall design. Informed consent was obtained from all sample individuals included in the study, the names of them were not asked so as

not to reveal their identities, and ethical approval for this study was obtained from the Medical Science University of Bushehr under the code IR.BPUMS.REC.1402.112. The study was carried out from May to September 2023.

Measures

1. **Demographic Characteristics**:

   The age, gender, marital status, and education level of each participant were recorded to assess the demographic composition of the sample group.

2. **Type D Personality Scale (DS-14)**

This scale was designed by Denollet et al. (2005). It comprises 14 items divided into two components: NA and SI, each containing 7 items. Scoring is based on a 5-point Likert scale ranging from 0 (false) to 4 (true), with items 1, 3, and 10 scored in reverse. Cut-point 10 is used to identify type D personality. If the score is below 10 in both subscales, the person does not have this personality type. If the score is higher than 10 in one of the subscales, the type D personality is in the intermediate degree. Moreover, scores higher than 10 in both subscales display a high degree of type D personality (Domagalska et al., 2021). In the present study, a high degree of type D personality has been considered a criterion for selecting the sample group. Previous studies have reported good reliability for NA and SI

components, with Cronbach's alpha values of 0.83 and 0.70, respectively (Lambertus et al., 2018, Lv et al., 2020). In the present study, the Cronbach's alpha for NA and SI was 0.65 and 0.56 in the pre-test and 0.66 and 0.61 in the post-test for the experimental group, respectively, while the control group showed values of 0.79 and 0.76 in the pre-test and 0.80 and 0.50 in the post-test.

3. **Coping Strategy Questionnaire:**

This questionnaire was developed by Zhao et al. (2022). It comprises 30 items across seven components: Withdrawal (6 items), Positive Adaptation (6 items), Problem-solving (6 items), Disengagement (3 items), Prosocial Focus (3 items), Seeking Emotional Support (3 items), and Self-regulation (3 items). Confirmatory factor analysis has validated these components, with fit indices indicating appropriate model fit (CFI=0.94, SRMR=0.07, RMSEA=0.08). The Cronbach's alphas for these components are 0.88, 0.87, 0.84, 0.75, 0.83, 0.73, and 0.76 respectively. Responses are scored using a five-point Likert scale ranging from never (1) to always (5) (Zhao et al., 2022). A back-translation was initially conducted by a professional translator familiar with psychology to assess the validity of this questionnaire within the Iranian population. Following the confirmation of the questionnaire's face and content validity, a confirmatory factor analysis (CFA) was performed on a sample of 200 Iranian college students to evaluate the seven-component

model of the questionnaire. The results of CFA supported the seven-factor structure within the Iranian context (CMIN/DF= 1.37, RMSEA=0.04, CFI=0.88, TLI=0.87, SRMR=0.06). Additionally, Cronbach alpha (0.74, 0.71, 0.70, 0.74, 0.66, 0.65, 0.76 for the mentioned components, respectively) and composite reliability (CR) (0.80, 0.71, 0.71, 0.81, 0.76, 0.77, 0.83, respectively) were computed for the seven components for these students. Overall, the validity and reliability were confirmed within the Iranian population. Additionally, Cronbach's alpha was computed for the present study sample group. The Cronbach's alpha for the pre-test in the experimental group was 0.74, 0.68, 0.70, 0.81, 0.74, 0.74, and 0.85, and in the control group, it was 0.60, 0.64, 0.62, 0.65, 0.77, 0.76, and 0.72. Post-test alphas for the experimental group were 0.64, 0.60, 0.62, 0.69, 0.65, 0.66, and 0.73, and for the control group were 0.60, 0.62, 0.60, 0.68, 0.70, 0.72, and 0.68.

4. **Android Application for Interpretation Bias Modification for Type D Personality**

Interpretation bias modification has been used based on scenarios about ambiguous situations in which individuals are trained to select unbiased interpretations of that situation. However, this intervention was used for depression and anxiety in previous research (Smith et al., 218, Fodor et al., 2020). Therefore, the designed intervention for type D personality was used in the present study. This intervention's application was

developed by the researchers of the present study based on prior qualitative research that identified 56 key interpretation biases relevant to Type D personality (Mousavi, Pakizeh, & Rajabi, 2024). Then, the interpretation biases correlated significantly with NA and SI were considered as the core content for forming each scenario for the intervention. The content validity was confirmed based on the content validity ratio (CVR) and content validity index (CVI) performed by 12 experts in this field (Mousavi, Pakizeh, Rajabi, et al., 2024). CVI was compared with 0.79, and CVR was higher than 0.56 (Lawshe, 1975) for all designed scenarios. This application is designed to deliver a 10-session online intervention, with each session comprising 25 ambiguous scenarios. These sessions were conducted over a period of 8 weeks.

For each session, participants are instructed to read the session guidelines and press the start button. Each scenario, consisting of four sentences, is then displayed, with participants having 20 seconds to read the entire scenario (5 seconds per sentence). Each scenario describes an event with an ambiguous outcome, followed by a yes/no question to confirm the participant's attention to the scenario content. This format is consistent across all sessions.

In sessions 1 and 10, after the initial part, four possible attitudes about the event are presented. Participants must judge each of these four statements as "appropriate" or "not

appropriate" based on their personal attitude. These statements vary in the degree of interpretation bias they represent, from highest to lowest. To prevent habitual responses and encourage thorough reading, the order of the statements is randomized.

The scoring for sessions 1 and 10 involves adding up the scores from the 25 scenarios in each session. A higher cumulative score indicates a higher level of interpretation bias. This scoring method aims to quantitatively assess changes in interpretation bias as a result of the intervention.

For sessions 2 through 9 of the intervention, the process begins similarly to sessions 1 and 10, where participants read the session guidelines, view a scenario, and respond to a yes/no question to ensure engagement with the content. Following this, the intervention introduces a critical component aimed at modifying interpretation biases.

After the initial yes/no question, participants are presented with a 4-point phrase related to the scenario. They are required to select one of the four displayed phrases that best represents their interpretation of the scenario. Immediately after their selection, feedback is provided to the participant along with a score reflecting the appropriateness of their chosen response. The scoring and feedback system is designed to challenge and potentially correct biased interpretations.

- **Feedback and Scoring**:
    - If the chosen phrase indicates a biased interpretation, feedback such as "completely false" or "partially false" is given, accompanied by a score of 0 or 1, respectively.
    - Conversely, if the response reflects an unbiased or less biased interpretation, the feedback will be "completely true" or "partially true," with scores of 3 or 2, respectively.

This structured feedback mechanism is intended to guide participants towards recognizing and adjusting their interpretation biases, thereby potentially reducing the influence of such biases on their thoughts and behaviors.

Sample Scenario and Scoring Example:

- **Scenario**: You feel that it is time to get married. You think about whether you are ready to live together. While reading a book about the duties of husband and wife towards each other, you conclude that you do not meet 100% of the conditions for marriage.
- **Yes/No Question**: Did you read the book "Duties of Husband and Wife Towards Each Other?"

- **Phrases for Selection**:
    - "Marriage in these conditions means disaster" (Score for appropriate: 3, not appropriate: 0)
    - "You should not take risk" (Score for appropriate: 2, not appropriate: 1)
    - "You should behave cautiously" (Score for appropriate: 1, not appropriate: 2)
    - "You should not wait for 100% conditions" (Score for appropriate: 0, not appropriate: 3)

Results

For analyzing data, SPSS-26 software was used to determine the demographic characteristics of the sample group, descriptive information of the coping strategies' components, and the effectiveness of a 10-session online interpretation bias modification on coping strategies.

Firstly, demographic characteristics show that 42 individuals were assigned to the experimental group and 42 individuals to the control group. Among the total sample group,

53 individuals (63.1%) were female and 31 of them (36.9%) were male. 65 individuals (77.4%) had a bachelor's degree, 14 (16.7%) had a master's degree, and 5 (6%) had a doctoral degree. Additionally, 70 individuals (83.3%) were single and 14 (16.7%) were married. The distinct demographic results for the experimental and control groups are reported in Table 1.

Table 1. Demographic information for both groups

Variable	Category	Experimental group n (%)	Control group n (%)
Gender	Female	27 (64.3)	26 (61.9)
	Male	15 (35.7)	16 (38.1)
Education	Bachelor	33 (78.6)	32 (76.2)
	Master	6 (14.3)	8 (19)
	Doctoral	3 (7.1)	2 (4.8)
Marriage	Single	36 (85.7)	34 (81)
	Married	6 (14.3)	8 (19)

Table 1 shows that females, bachelors, and singles had more frequencies in both groups. Additionally, the mean age was 23.54 (std=4.15) in the experimental group and 24.09 (std=5.26) in the control group. Descriptive information of variables is reported in Table 2.

Table 2. Descriptive information of type D personality and coping strategies in experimental and control groups

Variables		Mean		Std		Skewness		Kurtosis	
		Exp	Control	Exp	Control	Exp	control	exp	control
	Pre-test	31.66	31.47	6.62	8.20	.12	-.15	-.60	-.73

Type D personality	Post-test	24.19	28.54	6.27	7.67	.22	-.19	-.83	-.51
Withdrawal	Pre-test	18.04	20.07	4.35	3.04	-.275	-.142	-1.001	-.139
	Post-test	13.47	17.92	2.92	2.55	.161	-.018	-.255	-1.070
Positive adaptation	Pre-test	14.35	14.04	3.69	3.41	.436	.324	-1.014	-1.022
	Post-test	18.26	15.02	2.74	2.69	.323	.171	-.397	-.129
Problem solving	Pre-test	15.16	14.52	4.11	2.90	.475	.106	-.705	-.987
	Post-test	19.95	15.90	2.68	2.29	.394	.415	-.513	-.241
Disengagement	Pre-test	9.71	9.61	3.11	2.31	-.364	.020	-.869	-.406
	Post-test	7.21	9.14	2.24	2.11	.193	.242	-.104	-.614
Prosocial focus	Pre-test	9.09	9.54	2.84	2.88	-.034	.254	-.679	-.876
	Post-test	9.57	8.71	2.38	2.31	.163	.353	-.722	-.786
Seeking emotional support	Pre-test	7.50	7.04	2.43	2.30	.139	.115	-1	-1.133
	Post-test	10.09	7.50	1.96	2.05	.003	-.098	-.862	-.707
Self-regulation	Pre-test	8.45	7.35	3.55	2.28	.049	.013	-1.468	-.602
	Post-test	10.52	8.26	2.63	1.95	-.116	-.036	-1.502	-.246

Table 2 shows that all variables are within the normal range because the skewness is between -3 and 3, and kurtosis is between -10 and 10, indicating a normal distribution for all components. This is one of the assumptions of parametric tests such as MANCOVA (Demir, 2022). Additionally, the scores for type D personality, withdrawal and disengagement decreased in both groups. However, the scores for other coping strategies components increased. The changes in these components were more pronounced in the experimental group than in the control group. To determine the significance of the variables' changes after the 10-session intervention, a MANCOVA test was used, and its results are reported in Table 3.

Table 3. Multivariate test of the effectiveness of interpretation bias modification on coping strategies (MANCOVA)

	value	F	df	Error df	sig	Partial eta squared
Pillai's Trace	.628	18.338	7	76	.000	.628
Wilks' Lambda	.372	18.338	7	76	.000	.628
Hotelling's Trace	1.689	18.338	7	76	.000	.628
Roy's Largest Root	1.689	18.338	7	76	.000	.628

For using MANCOVA, assumptions were tested. Normality was confirmed based on skewness and kurtosis values. Subsequently, the homogeneity of the variables' variances between the two groups was tested through the M-box and Levene's test. The M-box result was 44.164 with a significance of .064, indicating homogeneity of variances. Additionally, Levene's test confirmed homogeneity for withdrawal, positive adaptation, and prosocial focus. However, it was not confirmed for other variables. Nevertheless, because the sizes of both groups are equal, the significance of Levene's test for these variables can be ignored, allowing the use of MANCOVA based on the confirmed assumptions.

According to Table 3, the effectiveness of the online interpretation bias modification on coping strategies is significant at the $p< 0.0001$ level ($F=18.338$, sig=0.000). The partial eta squared indicates that this intervention plays a significant role in the coping strategies of students with Type D personality. The between-group differences for each variable are reported in Table 4.

Table 4. Between group test of the effectiveness of interpretation bias modification on coping strategies

Dependent Variable	Leven	sig	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Withdrawal	.002	.961	123.857	1	123.857	24.928	.000	.233
Positive adaptation	3.221	.076	180.107	1	180.107	34.783	.000	.298
Problem-solving	4.098	.046	243.440	1	243.440	54.694	.000	.400
Disengagement	8.714	.004	86.012	1	86.012	35.446	.000	.302
Prosocial focus	.705	.403	2.012	1	2.012	1.266	.264	.015
Emotional support	8.484	.005	96.429	1	96.429	50.517	.000	.381
Self-regulation	4.369	.040	28.583	1	28.583	18.840	.000	.187

According to Table 4, implementing 10 sessions of online interpretation bias modification could influence all coping strategies except for prosocial focus, at a significance level of $p< 0.0001$. The partial eta squared values show the highest impact of the mentioned intervention on problem-solving and the lowest significant impact on the self-regulation component.

Discussion

The present study was conducted to determine the effectiveness of online interpretation bias modification on coping strategies in college students with Type D personality.

The results revealed that performing 10 sessions of interpretation bias modification, designed through qualitative research by the present study's researchers, can significantly affect the improvement of coping strategies in college students with Type D personality. According to Sumin et al. (2022), students with Type D personality tend to use more inappropriate coping strategies, such as avoidant-based strategies, as shown in the pre-test of the present research. For this reason, modifying the coping strategies of these individuals has been recommended in past research. In line with this recommendation, Lv et al. (2020) revealed the relationship between negative reappraisal and coping strategies of Type D personality individuals. Similarly, another study found that negative appraisal can affect emotion-focused strategies, and positive reappraisal can influence problem-focused strategies (Sharma & Gupta, 2023). Jones & Sharpe (2017) also reported that interpretation bias modification can change a person's appraisal towards people and the world. Furthermore, several studies demonstrating the effectiveness of cognitive bias modification on emotional problems align with the results of the present study. For instance, Smith et al. (2018) showed the effectiveness of this intervention on depression, and Fodor et al. (2020) revealed its effectiveness on anxiety. Additionally, in another study, the results demonstrated the impact of cognitive bias modification on post-traumatic stress disorder (Hett et al., 2022). On the other hand, numerous studies have shown the relationship

between Type D personality and emotional problems (Li et al., 2023) and the association of this personality type with maladjusted strategies (Lv et al., 2020). Thus, it is logical that interpretation bias modification could improve the coping strategies of individuals with Type D personality. In other words, modifying students' interpretations of vague stimuli can decrease their withdrawal and disengagement from situations and can also increase positive adaptation to new situations, problem-solving strategies, seeking emotional support from others, and self-regulation abilities. However, this intervention could not significantly change prosocial behaviors, possibly due to the stronger trait nature of prosocial behaviors compared to other coping strategies. In addition, since the participants had no problems with prosocial focus before the intervention based on its high pre-test mean, it may be possible that the intervention did not significantly improve this component.

Finally, the interpretation bias modification intervention used in this study has proven to be helpful for improving the coping strategies of students with Type D personality, as evidenced by the strong effect sizes. Therefore, the results can be utilized by individuals with this personality type and the experts who work with them. Additionally, the intervention was tailored and performed individually for each participant, which means that the sample individuals experienced it in different situations. This variability could have influenced the obtained results. Furthermore, the intervention was used for people with a

high degree of type D personality. Thus, it should be generalized for other degrees of this personality type with caution; and it is suggested that future researchers perform this intervention for all degrees of this personality type. In addition, Cronbach alpha for NA and SI was lower in the present study than in previous research. These lower values may be because of the difference between the sample groups, probably affecting Cronbach's alpha index (Cortina, 1993). Another limitation is that the sample size was determined based on sample power with a power of 60% due to practical constraints in the present study. Therefore, it is suggested that future researchers conduct similar research with a larger sample group to obtain 80% power.

Conclusion

The results of the present study revealed that online interpretation bias modification can influence on coping strategies in type D personality college students. Therefore, this intervention can be used to increase positive coping strategies and decrease negative coping strategies in this personality type. For this reason, it can be useful for extent range of people with physical and mental problems.

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Statements and declarations

Ethical Consideration

This study was approved by the Ethics Committee of Medical Science University of Bushehr under the code IR.BPUMS.REC.1402.112.

Consent for publication

All participants provided written informed consent prior to enrolment in the study.

Conflict of interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Data availability

Data available on request due to privacy/ethical restrictions.

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