Research Article

The Role of Brain/Behavioral Systems and Emotional Processing in Predicting Social Anxiety of Students

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Abstract

Background: Social anxiety disorders are among disorders that decrease the academic performance of students and cause emotional and behavioral problems.

Objectives: The aim of this study was to evaluate the role of brain/behavioral systems and emotional processing in predicting social anxiety of students.

Methods: This research was descriptive and correlational. The research population included all 5th grade male students of Ardabil city during years 2016 to 2017, among which 123 students were selected by the multi-stage cluster sampling method. Data collection was done through brain/behavioral systems scale, emotional processing, and social anxiety questionnaire. For data analysis, the researchers used Pearson's correlation and multiple regression analysis.

Results: The results showed mean (and standard deviation) of BAS, BIS, and FFS for emotional processing and social anxiety among students under study was 77.26 (2.76), 79.78 (57), 82.93 (3.25), 114.21 (22.84), and 32.41 (14.22), respectively. Also, the results showed that there was a significant negative correlation between behavioral activation system (BAS) and students' social anxiety (P < 0.001). Also, a significant positive relationship was found between behavioral inhibition system and fight-or-flight system with students social anxiety (P < 0.001). In addition, there was a negative correlation between social anxiety and emotional processing. Results of regression analysis showed that 46% of the variance in social anxiety of students was significantly explained by brain/behavioral systems and emotional processing variables.

Conclusions: Based on these results, it could be said that the relationship between individual differences, emotional processes, and brain behavioral processes can be an important factor in dealing with anxiety.

Keywords: Brain/Behavioral Systems, Emotional Processing, Social Anxiety

1. Background

Social anxiety disorder refers to marked and persistent fear of embarrassment or humiliation in social or performance situations. According to DSM-5 (diagnostic and statistical manual of mental disorder), it is an intense and persistent fear of situations, in which one is among a group of people or should perform in front them (e.g. giving presentation). The prominent feature of social anxiety disorder is the marked and persistent fear of social and performance situation (s) when one is walking to a room full of strangers or they might feel they are focused of attention (1). On the other hand, social anxiety disorder is a fear of social situations and includes a kind of scrutiny or there is a relationship with strangers. Moreover, people with social anxiety disorder refuse being among others or make a speech for

fear of blushing and embarrassing themselves. They might have special fear of writing among or eating with others (2). The estimated 12-month prevalence of social anxiety is 0.07 in America. Generally, the prevalence of social anxiety among females is higher than males. Social anxiety disorder in America typically begins at around age 13 and in 75% of cases, the onset of the disorder is between 8 and 15 years old (2).

One of the most comprehensive theories about anxiety/fear that can cast light onto the effect of anxiety on students' performance is reinforcement sensitivity theory (RST) (3). This theory considers personality traits a window to personal differences in brain function. Like Eysenck, Gray believes that one can identify brain processes through a conceptual nervous system, which includes key circuits related to personality and behavior

(4). Gray represented a biological model of personality includes three brain-behavioral systems. He believed that these systems form the basis of individual differences and when each system is activated, one may experience different emotional reactions, such as timidity, anxiety, and fear. The first one is behavior activating system (BAS), which responds to conditional reward and non-punishment stimulus. Activity and increase in the sensitivity of this system will stimulate positive emotions, approach, and active avoidance. Nervous Anatomical Foundations of this system, which is structurally connected to dopaminergic passages and cortico-striato-pallido-thalamic (CSPT) circuitry placed in prefrontal cortex, amygdala and Basal ganglia.

The sensitivity of behavior activating system indicates the impulsivity of an individual (3, 5). Behavior inhibition system (BIS) is the second system, which is sensitive to conditional punishment and non-reward stimulus; it is also sensitive to new and naturally frightening stimuli (3). The activity of this system will evoke anxiety, behavior inhibition, passive avoidance, extinction, and increasing attention. The bases of this system is nervous anatomy, the increase of which will increase anxiety (6) placed in orbitofrontal cortex, septohippocampal system, papez circuit (7). The third one, fight/flight system, structurally connected to amygdala and hypothalamus is sensitive to annoying stimuli. The behavioral component of this system, the high activity of which relates to psychoticism, is fight (defensive aggression) and flight (escape from punitive source) (8). In 2000, Gray revised RST to FFFS which stands for fight/flight/freezing system was added. It is responsible to react against bad stimuli both, conditioned and unconditioned types (9). In the new form, BAS remained unchanged. The BIS is responsible for controlling the conflict between goals and acts as an intermediary between anxiety responses, while the FFFS has a mediating response to the fear of punishment (8). The BAS is thought to be activated with appetitive stimuli and leads to goal directed behavior, reward seeking, and positive feelings. On the other hand, the BIS is thought to be activated with aversive stimuli and leads to inhibitive behaviors, such as anxiety, withdrawal, and sensitivity to signals of punishment (10). The conducted studies indicate that brain/behavioral system plays an important role in psychological disorders and anxiety disorder in particular. Another research observed a significant relationship between different dimensions of reinforcement sensitivity theory and social cooperation anxiety as well as social observation anxiety in a way that the brain/behavioral system of both indicated a positive relationship with SP, BIS-anxiety, BIS-fear, and a negative relationship with BAS-FS (11). The results obtained from other research indicated a positive relationship between behavior inhibition system and social anxiety, the

existence of which represented through negative affection and depressed mood (12).

Among the important variables that affect the way to which one acts against unfavorable and stressful situations, and anxious moments in particular, one can name emotional processing. This concept was introduced by Rachman (13) in 1988 as a defining concept of anxiety disorder and developed by Foa and Kozak (14). Rachman conceptualizes emotional processing as a return to non-pathological behavior after return to emotional distress. He believes that before using the concept, one should consider following three conditions: (1) There should be evidence of emotional distress, (2) There should be evidence of decrease in emotional distress, and (3) There should be evidence of return to normal and non-pathological behavior. If the first condition is not met yet the other two, then it could be said that emotional processing was not done completely. Baker et al. showed the role of emotional processing in treating panic disorder. They discussed the lack of emotional processing as a damaging factor in treating panic disorder (15). Other studies suppose that emotional processing could lead to individual's well-being in the long-term (16). There is plenty of evidence on the role of emotional processing in treating anxiety disorder, which shows that emotional processing plays an eminent role in adjusting to anxiety. Rachman, for example, discussed that damaging tensions are often due to incomplete emotional processing. Furthermore, emotional processing is considered as one of the most important elements in the literature of clinical anxiety disorders (14). It is widely accepted that recovery from anxiety disorder could be defined by experiencing key elements of treatment through exposure to fears, panic disorder, obsessive-compulsive disorder, and post-traumatic stress disorder (17). According to Rachman, there are four factors that can endanger emotional processing, which include cognitive avoidance, lack of experiencing short-term habituation, depression, and overvalued beliefs. The results indicated that people with weak cognitive styles in terms of emotional processing, such as rumination, catastrophizing, and self-recrimination are more susceptible to emotional problems than other people. While people with suitable styles, such as positive re-evaluation, are less susceptible (13). Previous studies showed that emotional processing plays an eminent role in managing and controlling psychological disorders such as traumatic symptoms (18), depression (19), aggression (20), compatibility (21), and anxiety disorders (22).

2. Objectives

With regards to the literature and importance of variables under discussion, the current study investigated

whether brain/behavioral systems and emotional processing predict social anxiety disorder among students.

3. Methods

This research was descriptive and correlational. In this study, the brain/behavioral system and emotional processing are independent variables and social anxiety is a dependent variable. The population of the study was all fifth-grade male students in Ardabil city during years 2016 to 2017. In this study, 123 students were selected by multi-stage cluster sampling method. First, the researchers divided the city to three northern, central, and southern regions and then from among the schools of each region, five schools and from each school two classes were selected randomly as the sample. Inclusion criteria included high IQ scores, not suffering from intellectual disability or other diseases. Exclusion criterion was the participants' unwillingness to cooperate. Following tools were used for data collection.

3.1. Gray-Wilson Personality Questionnaire (GWPQ)

Wilson, Barrett, and Gray designed this questionnaire in 1989 (23). This questionnaire assessed dominance and sensitivity of brain-behavioral systems and their components. It includes 120 questions, which are used to study behavior activating (40 items), behavior inhibition (40 items), and fight-flight systems (40 items). From 40 items related to behavior activating system, 20 items were designed for approach component and the remaining 20 items for active avoidance component. From 40 items of behavior inhibition, 20 items were designed for passive avoidance and the remaining 20 items for extinction. Similarly, from 40 items related to fight-flight system, 20 items were designed for fight component and the remaining 20 items for flight component. Each of the questions had three options: "yes", "no" and "I do not know". "I do not know" option was chosen when a participant could not answer a question with "yes" or "no" at all. In answering every item with a +, "yes" obtained two scores, "I do not know" one score and "no" no score. In answering every item with a -, "yes" had no score, "do not know" one score, and "no" two scores. With regards to reliability of this questionnaire, Wilson, Barrett, and Gray defined the coefficients of Cronbach's alpha for males at 0.71, 0.61, 0.58, 0.61, 0.65, 63 and for women at 0.68, 0.35, 0.59, 0.63, 0.71 and 0.71 for approach, active avoidance, passive avoidance, extinction, fight and flight, respectively, which indicated internal reliability of the test. Moreover, through the correlation among GWPQ components and Eysenck's personality questionnaire, they showed the convergent validity of the test (23). This questionnaire was translated to Persian by Azadfallah et al. and conducted on a group of 211 Iranian students (24). Moreover, in the case of reliability of this scale, Ashrafi reported Cronbach's alpha coefficients of 0.60, 0.54, 0.61, 0.66, 0.65, and 0.69 and through split-half method consistency coefficients of 0.53, 0.57, 0.52, 0.62, 0.64, and 0.64 for such components as approach, active avoidance, passive avoidance, extinction, and fight and flight, respectively (25).

3.2. Emotional Processing Scale

The emotional processing scale is a 38-item self-report questionnaire that assesses emotional processing styles over the last week (26). Each item was graded according to Likert's five-point scale (ranging from "not at all" to "extremely") and each person's score ranged from zero to 152. This scale had eight components (trouble, suppression, lack of knowledge, lack of control, separation, avoidances, disturbances, and external factors). Psychometric properties, especially with regards to identifying the differences between groups, are promising in the revised version. The coefficients of Cronbach's alpha and test retest of this scale were reported as 0.92 and 0.79, respectively. For defining reliability, a research correlated the scale with emotion regulation. The results showed that there was a negative meaningful correlation (r = -0.54) between these two scales; in a primary research conducted on 40 students, the obtained reliability was 0.77 (26). Furthermore, construct validity of the test through factor analysis indicated that the test is saturated with eight factors called trouble, suppression, lack of knowledge, lack of control, separation, avoidances, disturbances and external factors in which the first factor holds the highest share.

Also, the results of the study to determine the content validity using experts' point of view, the content validity of the questionnaire, and the results of the exploratory factor analysis of the main components through the varimax rotation, showed that there are eight factors with a greater value than one with the title of trouble, suppression, lack of knowledge, lack of control, separation, avoidances, disturbances, and external factors (27). Lotfi (27) reported the coefficients of Cronbach's alpha and reliability (dependability) of this scale as 0.81 and 0.85, respectively. The obtained Cronbach's alpha coefficient was 0.84 in this study.

3.3. Social Anxiety Inventory

This scale was made by La Greca et al. (28). It contains 18 descriptive self-statements and four filler items reflecting activity preferences ("I like to read") or social preferences ("I like to play with other kids"). Each item is rated on a five-point scale, according to how much the item "is true for

you" (one = not at all, five = all the time). Based on factor analytic studies, three distinct subscales have been identified. The first subscale, fear of negative evaluation (FNE), reflects fears, concerns, or worries regarding negative evaluations from peers; it includes eight items (e.g., "I worry about what other kids think of me"). In addition, there are two subscales for social avoidance and distress: SAD-New and SAD-General. The SAD-New reflects social avoidance and distress with new social situations or unfamiliar peers; it includes six items (e.g., "I get nervous when I meet new kids"). The SAD-General reflects more generalized or pervasive social distress, discomfort, and inhibition; it includes four items (e.g., "I feel shy even with kids I know well"). Scores are obtained by summing the ratings for the items comprising each subscale, and can range from 8 to 40 for FNE, 6 to 30 for SAD-New, and 4 to 20 for SAD-General; total scores can range from 18 to 90. The reported reliability of retest (in a time span of three to seven days) ranged from 0.89 to 0.94 and the coefficients of Cronbach's alpha ranged from 0.90 to 0.97. The coefficients of Cronbach's alpha for subscales of fear and avoidance were 0.91 and 0.89, respectively (29). Ostwar and Razavie (29) reported the coefficients of Cronbach's alpha and reliability (dependability) of this scale 0.93 and 0.87, respectively.

3.4. Procedure

After obtaining license from the education and the subjects, the researchers first defined the objectives then asked them to fill in the questionnaire. Data were collected individually from the related schools. Finally, the obtained data were analyzed through Pearson's correlation coefficient and multiple regression analysis. Protecting respondents' confidentiality and their complete freedom to participate were among the ethical issues in this research. In other words, the participants were fully aware of the study objectives and willing to participate, and were allowed to leave the project at any time. The research also used anonymous questionnaires. Furthermore, written consent was obtained from both students and their teachers to participate in the research.

4. Results

The mean and standard deviation of students' age in this study was 10.44 and 0.4, respectively. Among the fathers of the students participating in the study, 41% (51 people) had a free job and 59% (72 people) were employees. Also, among the fathers of the students studied, 37% (45 people) had high school diploma education, 24% (30 people) had diplomas, and 21% (26 people) and 18% (22 people) were Master's degree and more. In addition, among

the mothers of the students studied, 59% (72 people) were housewives, 23% (29 people) had free jobs, and 18% and 18% (22 people) were employees. Also, among the mothers of these students, 45% (56 people) had undergraduate education, 24% (29 people) had high school diploma education, and 19% (23 people) and 12% (15 people) had a Master's degree and more.

Mean (and standard deviation) of BAS, BIS, and FFS, emotional processing and social anxiety among students under study were 77.26 (2.76), 79.78 (57), 82.93 (3.25), 114.21 (22.84), and 32.41 (14.22), respectively.

According to Table 1, there was a negative relationship between behavior activating system (BAS) and social anxiety (SA) of students. Moreover, there was a positive relationship between behavior inhibition system (BIS) and fight/flight system with social anxiety of students. Also, there was a negative relationship between emotional processing and social anxiety. That is, with the increase in emotional processing, social anxiety decreases among these students.

For defining the role of each variable in predicting social anxiety of students, the researchers used multiple linear regression analyses (Enter method).

The obtained value of R^2 indicated that about 60% the variance of social anxiety (as a dependent variable) was explained through independent variables of brain-behavioral system and emotional processing.

As you can see from Table 2, variables of emotional processing, behavior activating system (BAS), behavior inhibition system (BIS), and fight/flight system can predict social anxiety.

5. Discussion

This research was conducted to study the role of brain/behavioral system and emotional processing in predicting social anxiety of students. The results indicated that there is a negative relationship between subscales of behavior activating system and social anxiety. Moreover, there was a positive relationship between behavior inhibition system and fight/flight system with social anxiety of students. The findings were in line with the findings of previous studies (7, 8, 11, 12) and indicated that brain/behavioral system can predict social anxiety of students. To justify the findings, it could be said that anxious people and those, who live in seclusion through activation of BIS may exhibit anxious behavior such as aloofness, because due to lack of concentration, their inhibition systems make them susceptible to such behaviors. Through increasing the activity of BIS, they tend to avoid being with other people. The findings reflect the opposite performance in hyperactive people. They compensate

Table 1. Correlation Matrix Between Brain-Behavioral System and Emotional Processing with Social Anxiety of Students

	BAS	BIS	FFS	EP	SA
BAS	1				
BIS	-0.92[**]	1			
FFS	0.20[**]	-0.44[**]	1		
EP	0.26[**]	-0.79[**]	0.58[**]	1	
Social anxiety	-0.68[**]	0.52[**]	0.55[**]	0.79[**]	1

Table 2. Multiple Linear Regression of Brain/Behavioral System and Emotional Processing With Social Anxiety as a Dependent Variable

Independent Variable	Dependent Variable	SE	B	β	t	P
Behavior activating system (BAS)		1.15	-0.22	-0.48	-5.03	0.001
Behavior inhibition system (BIS)	Social anxiety	0.73	0.16	0.37	4.63	0.001
systemsystem		0.59	0.16	0.39	3.85	0.001
Emotional processing		0.50	-0.09	-0.35	-5.80	0.001

their low cortical excitement (24) through external stimuli; on the other hand, it could be inferred that high activity of BAS makes them hyperactive individuals. As mentioned previously behavior activating system is an infrastructure for such states as expecting pleasure and happiness (24) while behavior inhibition system is mixed with anxiety and neuroticism that leads to stopping the behavior against threats and the responses of fight/flight system emerge in the form of aggression and flight (3). In their study, Gomez et al. concluded that there is a positive correlation between BIS and neuroticism and a negative correlation between BIS and extroversion; on the contrary, there is negative correlation between BAS and neuroticism and positive correlation between BAS and extroversion. This finding is in line with previous findings (24). The hypothesis is that hyperactivity of BIS leads to personality traits that provoke anxiety and make people susceptible to anxiety disorder. In support of this hypothesis, Fullana et al. found that people with symptoms under the clinical threshold of obsession and people suffering from obsessive-compulsive and anxiety disorder are more sensitive to punishment (7). The results indicate a high activity of BIS in these people. According to Gray, people with strong BIS react through inhibiting their current behavior to the signs of punishment, lack of reward, and new stimuli. They increase their preparedness to act and change their attention to environmental stimuli, which was also observed in the current study.

Inhibition behavior is related to negative emotional states and processes and this system can help directly to understand the nature of emotional disorders. Behavior inhibition system, which includes the septo-hippocampal system and its mono-minergic afferent neurons expanded from brain stem and neocortical projective areas in frontal lobe, provides motivational bases for behavior inhibition that may lead to negative consequences, especially in anxious and new situations (3, 9). Moreover, the results indicated that there was a negative and meaningful relationship between emotional processing and social anxiety of students. On the other hand, with the increase in emotional processing and its utilization by students, their social anxiety would decrease. This finding is in line with the findings of other studies (namely 18, 19, 20, 21 and 22) and indicates that the manner, in which emotion is regulated and processed plays an important role in resolving psychological disorders, such as social anxiety. To explain these findings, it could be inferred that emotion is an eminent factor in determining health and having successful performance in social cooperation and the deficiency in emotion can lead to anxiety disorders and isolation (30). Anxiety disorder is basically an emotional disorder rooted in spontaneous and unsuitable outburst of negative emotions (such as fear and sadness). In fact, overestimating or magnifying the intensity of emotional disturbance and psychosomatic symptoms in anxious people can bias information processing in its general meaning and in the case of negative emotions, this tacit bias can reflect a damaging factor for anxiety disorders. Patients with social anxiety created a communicative network between stimulus-response and their interpretation. Naturally, with observing every symptom of these elements, one may experience fear. The most important thing in treating these patients is to separate the stimulus from the response and form a set of new information and a new schema for changing the manner, in which the patient confront the situation. Therefore, it can be said that emotional processing is a continuum of important changes in informational structure, in which some elements continue substituting the previous elements and finally as a result of feedback metabolism, creates changes in the set of beliefs and feedbacks, i.e. in schemas. With regards to the fact that creating change in emotional processing is very effective in

therapeutic efficiency, one could conclude that emotional processing in patients with social anxiety disorder is deficient and is an important factor in persistence of this disorder (30). Rachman states that damaging tensions is often due to deficient emotional processing. Anxiety is a psychological phenomenon and a theoretical concept in psychology, with cognition and affection playing important roles. Wells believes that since people process information selectively (Pincus and Williams), it is usually biased and is considered as a dangerous factor for developing a chronic disorder or a health threatening condition. Hence, the important role that bias can play in information processing is emphasized in the majority of cognitive theories (13). When an individual with social anxiety enter in an anxious social situation, his attention changes from environment to himself. Since social phobia is equivalent to fear of negative evaluation, this may lead one to focus on others' reactions to his/her behaviors. As mentioned above, this predicted negative evaluation from other people about one's own performance creates more anxiety that has physiological, cognitive and behavioral components, and affects one's imagination from appearance or observing behavior of others and this cycle will renew. Generally, it seems that variables of emotional processing and fear of negative evaluation play important roles in creating social anxiety disorder and can predict this disorder (30).

5.1. Conclusions

All in all, it seems that Gray's theory and emotional processing can effectively define social anxiety disorder through the emphasis on the relationship between brain/behavioral mechanisms and regulating the manner of processing and controlling emotions. Among the limitation in this research is selection of the sample, which limits its generalization to other group of people. Moreover, the current research included fifth-grade male students in Ardabil city, which makes it hard to generalize the results to other regions and age groups. Therefore, in generalizing the results, one should act carefully. Hence, using the required variables in other geographical regions of Iran and conducting research on other age groups are suggested for future studies. Also, self-reporting forms have been used in this research. Therefore, it is suggested that in future studies, teacher-reporting forms must be used to compare the results. Furthermore, regarding the role and importance of emotional processing in explaining social anxiety disorder, a clinical recommendation can be that counseling and psychological counseling centers should use therapies based on emotional regulation and emotional processing to reduce the symptoms of social anxiety disorder. Additionally, according to the emphasis of the research on the role of attachment and parenting styles, it is impossible to ignore the importance of parent-child relationships and its effect on anxiety disorders. Therefore, in the practical application of the research, the need for parents to provide psychological services during the evolution of their children should be emphasized so that families succeed in interacting with their children and help them to prevent and reduce mental disorders, including social anxiety.

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