Predicting Academic performance: The role of Brain Behavioral System, Cognitive Emotion Regulation Strategies, Mood Symptoms, and Sleep Quality

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Abstract: *The goal of this research was to study the brain behavioral systems, cognitive emotion regulation strategies, mood symptoms and sleep quality anticipants of academic performance in second year high school students. The research method was descriptive and correlation (casual modeling). The statistical society included all of students in khormabad city in academic year 2016. By using cluster sampling, 370 students (170 female and 200 male) were selected and answered the Questionnaires: Brain–Behavioral System, Cognitive Emotion Regulation Strategies, Depression, Anxiety Stress scale (DASS-21) and Pittsburgh Sleep Quality index (PSQI). Data was analyzed based on structural equation modeling. The results indicated that the analyzed data fitted the theoretical model and the model proved to be valid in this regard. The investigation of the results showed that all the casual ways towards the academic performance are meaningful. Among the examined varieties in the model, the depression, anxiety stress sleep quality are capable to predicting academic performance better and stronger than other varieties and also can be used for enhancing the mental health level of student.*
Keywords: *Brain Behavioral System, Academic performance, Cognitive Emotion regulation strategies, Sleep Quality*

INTRODUCTION

Nowadays, the education is known as a basic pillar of sustainable development and the authorities have been always to study the factors affecting students' academic performance (Attar Khameneh & Seyf, 2009). Academic performance is a success in passing the various courses by a student or an undergraduate; showing the proper performance in society and life has based on learned subjects. On the contrary, lowering of academic standards can impose the essential socio-economic costs on the societies (Tamannayi, Salami & Dashtbanzadeh, 2011). Academic performance depends on several factors on which have been not obtained a full knowledge, neither on their number and kinds nor their importance ratios. However, the experts study these factors in the form of three categories of individual factors, intra-organizational factors and extra-organizational factors (Tamannayi Far, Niazi & Amini, 2006).

Quality of life and activity of the individuals in waking are at large under the influence of quality of sleeping (Kepperman, Kubeek, Patrick, & Stewart, 1995). The sleep quality is one individual biological factor which can affect academic performance. In this regard, (Cucio & Ferrara, 2006) have shown that sleep disorder is associated with lowering of educational standards and reducing performance in the classroom and on the other hand it prevents the students to participate in the classroom and causes their sleepiness when participating in class. A lot of hormones are released during sleep and increase in cellular nutrition and

chemical changes take place as the body is prepared for the next day's activities. In addition, repair, reorganization, strengthening memory and learning occur in the nervous system. In addition, sleep causes the reduction of stress, anxiety and nervous stresses and helps recycling energy in person again for a better concentration (Zakeri Moghaddam, Kazemnazhad & Qadyani, 2006).

In addition to the sleep quality, some mood disorders such as anxiety, depression and stress can also have a devastating impact on academic performance (Gamon & Morgan, 2005). Anxiety, depression and stress are not in itself disorders; however when they make problem in the life function, they are known as disorder symptoms (Dadsetan, 2010). Depression symptoms make changes in emotions, cognition and motivation and by creating a false and negative beliefs and knowledge in students in relation to their abilities can lead to poor performance in education activities (Anbari, Jamilian, Qomi & Moslemi, 2013). Anxiety and stress also are roots of many physical problems and frustrations that cannot be destroyed. Anxiety reactions are general especially in threatening conditions; however, extreme stress and anxiety may make a person to be incapable and interfer with effective performance (Sadeghian, Moghaddari & Gorji, 2010). In this regard (Carlson & Holi, 1993) suggest that depression, anxiety and stress as a mood disorder can be of negative effect on the everyday activities, including academic quality. In this regard, (Spernak, Skater & Rami, 2006) and (Ghamari, Beygi & Salehi, 2010) revealed that students having poor general health have lower academic performance scores. Symptoms of depression, anxiety and stress are classified in the form of emotional problems (Fathi Ashtiani, 2009) and with proposing emotion regulation skills many experts (Lazarus, 1994, Thompson, 1994; Gross, 2001) try to control and cure these symptoms.

Cognitive emotion regulation strategies are applied to individuals' manner of thinking after occurrence of a negative experience or traumatic event. Previous researches have conceptually recognized nine different cognitive emotion regulation strategies: self-blame, acceptance, rumination, positive refocusing, refocus of planning, positive reappraisal, putting into perspective, catastrophizing and others-blame (Garefski, Craaij et al, 2002). People use different strategies for regulating emotions that can be adaptive or non-adaptive (Aldao, Nolen-Hokesma & Schweizer, 2010). On this basis, the use of non-compromised strategies can lead to depression, anxiety and stress (Garefski and Craig, 2006). In this regard (Yousefi, 2006) in his research showed that the cognitive strategies of self-blame, rumination, positive reappraisal, catastrophizing and others-blame are the most important predicting factors of depression and anxiety (Garefski, 2005). Also in a research that explores the psychological stress and cognitive regulation strategies, it has been shown there is a positive relationship between the psychological stress and self-blame, others-blame, rumination and refocus of planning and there is a negative correlation between psychological stress and the positive reappraisal; on this basis, it can be said, the lack of cognitive and emotion regulation strategies, due to the direct effectiveness on symptoms of depression, anxiety and stress, can be of indirect effect on academic performance.

In addition to cognitive emotion regulation strategies, the brain-behavioral systems can also cause academic performance of students to confront with problem through being of effect on depression, anxiety and stress (Azad Fallah, 2005). Gary's personality theory (2010) pays attention to the existence of relationship between personality and brain processes in the form of the theory of behavioral activation/behavioral inhibition systems, similar to Evsenk's theory. For explaining the individual differences this theory refers to the role of biological and neurological factors. Gary showed that early excitement and anxiety are major aspects of personality. Gary's model states that different brain structures set up basic motivational systems that interact with behavioral reinforcement. Behavioral activation system (BAS) that represents the sensitivity to signs of rewards and makes the person to be sensitive to the potential rewards and find motive to search for these rewards. This system is high reaction factor. Gary knows the nervous basis of activation system as the activity of mesolimbic dopamine system. Behavioral inhibition system (BIS) which is responsible for responding to the signs of punishment and makes a person to be sensitive to the potential punishment and avoid it. This system leads to anxiety, inhibition and passive avoidance in response to signs of punishment and new stimuli; it is known as anxiety system. The influence of behavior brain systems on emotions such as

anger, depression and anxiety in many researches (Garoussi, Nazari & Rostami, 2011; Sultan Mohammadlou, Ghorabi, Fahali Lavasani & Gohari, 1990); (Alloy, Abramson, Walsaw and Cogswell, 2008) (Ayyoubi, Yousefi & Ali Moradi, 2011) has been confirmed, so that the activation system is associated in particular with the emotions such as anger and anxiety and inhibition system with depression (Tsan, Day, Schwartz & Kimbrel, 2011); accordingly, the behavioral brain systems can be indirectly of effect on the academic performance of the individual, however most of the past researches (Segarra, Poy, López and Molto, 2014; Van Beek, Kranenburg, Taris and Schaufeli, 2013) have studied either the impact of behavioral brain systems on the emotions or directly the personality individual characteristics; however, there are still a lot of ambiguities about indirect relations of the behavioral brain systems, emotion regulation and mood disorders with behavioral outputs like academic performance; the present research sought to test the structural model and the direct and indirect relationships between the mentioned variables.
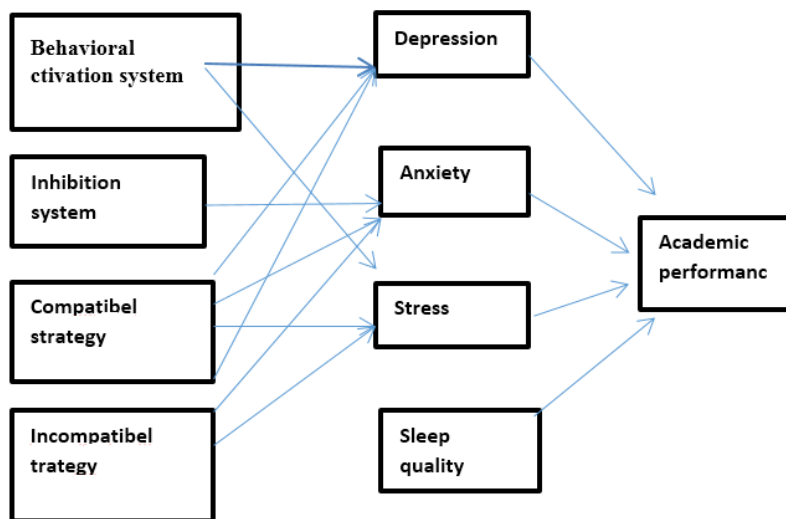
Figure 1: conceptual research model

2. Method

2.1. Participants

Statistical population is composed of all male and female students in public and private high school of third grade in Khorramabad in the academic year 2014-15; on the basis of cluster random sampling method and using Morgan table 370 people as sample were selected (200 males and 170 females).

2.2. Instruments

2.2.1. Behavioral inhibition/activation systems (BIS/BAS)

For measurement of variables the behavioral inhibition/activation systems questionnaire (BIS/BAS) was used: this questionnaire is a self-report made by Carver and White (1994). It contains 24 items and two main scales: the scale of the behavioral inhibition system and behavioral activation system. Sub-scale BIS in this questionnaire includes seven items that measure the sensitivity of behavioral inhibition system in response to the threat signs. On the other hand the sub-scale BAS also includes 13 items that assess the behavioral activation system sensitivity. BAS on this questionnaire consists of three sub-scales: drive (4 questions), fun seeking (4 questions) and reward responsiveness (5 questions). The sensitivity of the behavioral inhibition system is (7 questions). Questions 1, 6, 11, 17 on this scale are not scored and questions 2, 22 are scored

reversely. The internal stability of the scale BAS/BIS is respectively equal to 0.74 and 0.71. The Persian version of this scale which has been validated on students of Shiraz has shown a desirable psychometric properties, so that by method of test-retest for the scale BAS, its validity has been reported as 0.68 and for sub-scale BIS 0.71. Abdollahi Majarshin (2010) the validity of the questionnaire by method of test-retest for BAS scale has reported 0.78 and for sub-scale of BIS by 0.81. In this research, the total reliability of entire test by using Cronbach's alpha coefficient was obtained by 0.69.

2.2.2. Cognitive emotion regulation strategies (CERQ)

This scale is a 36-item measurement tool that has been articulated by Ganefski et al (2001) in Netherland to assess the difficulty in regulating emotion and has two versions in English and Dutch. Factor analysis is related to 9 factors in sub-scales which is associated with the different aspects of emotional regulation. Strategies are divided into two categories: 1- non-adaptive (negative) that includes four sub-scales and are as follows: self-blame including questions (1-10-19-28), rumination (3-12-21-30), catastrophizing (8-17-26-35) and others blame (9-18-27-36); 2- adaptive (positive), which consists of five sub-scales including: acceptance with questions (2-11-20-29), positive refocusing (4-13-22-31), refocus of planning (5-14-23-32), positive reappraisal (6-15-24-33), putting into perspective (7-16-25-34); these scales in total score (Cronbach's Alpha coefficient equal to 0.90) and in all the sub-scales (Cronbach's Alpha coefficient greater than 0.80) have inner stability. Every 9 scales of DERS have the Cronbach's alpha higher than 0.80. Based on the findings of the research of Azizi, Mirzayi and Shams (2010) the amount of Cronbach's alpha of Persian version of this questionnaire was estimated by 0.92.

2.2.3. Depression, anxiety and stress DASS-21

Depression, anxiety and stress symptoms questionnaire of DASS-21 was prepared by Laubond & Laubond in 1995. This scale has two forms. The short form contains 21 phrases that evaluate each of the mental constituents of "depression", "anxiety" and "stress" by 7 different phrases. In this scale the depression factor includes behavioral symptoms combined with dysphoria state (discomfort and feeling of being worthless) that includes questions (12-8-10-6-9-11-21), and anxiety factor including symptoms like (physiological motivations, fear and phobia) that includes questions (4-2-5-7-1-3-13), and stress factor (psychological pressure) including symptoms such as (psychological pressure feeling, feeling of difficulty) which includes questions (16-17-18-19-14-15-20). Laubond and laubond have reported the coefficient of internal consistency (Cronbach's alpha) of three sub-scales of depression, anxiety and stress respectively by 0.91, 0.81 and 0.89. Besharat (2007) has reported coefficient of Cronbach's alpha of scale of depression, anxiety and stress in the examples of the general population (n = 278), 0.87 for depression, 0.85 for anxiety, 0.89 for stress and 0.91 for total scale.

2.2.4. Petersburg sleep quality (PSQI)

In the present study for studying the sleep quality of students the Pittsburgh sleep quality questionnaire was used. Pittsburgh questionnaire is a tool for measuring the sleep quality and pattern. This questionnaire distinguishes appropriate from inappropriate sleep with assessing 7 features of sleep during the last month; these cases include sleep quality in terms of individuals, the length of time it takes to go to sleep. Length of sleep, sleep efficiency, sleep time problems, the use of hypnotic drugs and daily dysfunction: the individual himself answers to this questions. Scoring answers is done on the basis of zero to 3; score 3 represents the maximum negative score in the Lickert scale and total score of 5 or more indicates the undesirable sleep. Internal similarity and its reliability coefficient (Cronbach's alpha) is 0.83, except for the case of 7. Pittsburgh sleep quality is of validity of 86.5 and reliability of 89.5 (Shahri, 2009).

2.2.4. Academic performance

for evaluating academic progress of the students the school report card is used based on their average grade in previous semester.

2.3. Procedure and data analysis

The method of performing this research is descriptive (non-experimental) and the correlation research project is of type of structural equation pattern matching. Because in this research the relationships among variables are investigated in the form of the causal pattern.

3. Results

Before dealing with the structural model test, the descriptive indicators of variables are provided for studying the proper dispersion and normality of data distribution. In table 1 these indicators have been provided; the mean statistics values and standard deviation show the proper data dispersion and the skewness and kurtosis values the normality of data distribution.

Table 1: Descriptive indicators of research variables

Variable	minimum	maximum	mean	standard deviation	skewness	kurtosis
Depression symptoms	0	21	6/46	4/81	0/73	**-0/16**
Anxiety symptoms	0	19	5/88	4/67	0/84	**-0/04**
Stress symptoms	0	21	7/71	5/24	0/56	**-0/53**
Sleep overall quality	0	12	3/65	2/80	0/59	**-0/28**
Adaptive strategies	5	99	52/90	13/54	-0/09	**0/53**
Non-adaptive strategies	16	74	40/45	10/58	0/37	**0/48**
Behavioral inhibition systems	1	25	14/97	3/59	-0/23	**0/49**
Brain activation system	13	56	24/35	5/13	0/71	**0/72**
Academic performance	2	20	16/95	1/91	-0/89	**0/91**

For testing conceptual model the maximum probability method was used and for testing research theoretical model and fitting the collected data was used. It should be noted that LISREL Amos 20 software was applied for data analysis. In Figure 2 the tested pattern for present research has been provided.
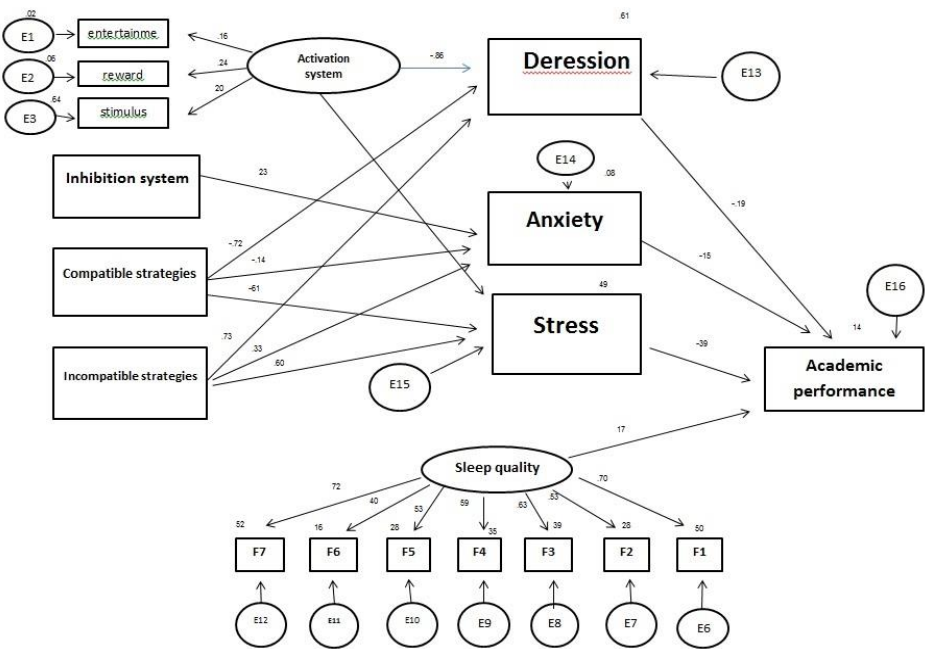
Figure 2: tested research model

Test results of the model have been shown in Figure 1, and the estimation results of direct paths, t-values and their significance level have been indicated in the following table.

Table 2: direct paths values, t-values and significance level

Path	Parameter estimation	Path coefficient	Estimation standard error	T statistic	P
On academic performance by					
Depression	-0/03	-0/19	0/02	-2/45	0/01
Anxiety	-0/06	-0/15	0/02	-2/99	0/01
Stress	-0/14	-0/39	0/02	-6/58	0/001
Sleep quality	0/22	0/17	0/21	3/08	0/001
On depression by					
Activation system	-1/91	-0/86	4/76	-3/49	0/001
Adaptive strategies	-0/26	-0/72	0/07	-3/61	0/001
Non-adaptive strategies	0/33	0/73	0/08	4/29	0/001

On anxiety by					
Inhibition system	0/03	0/23	0/07	2/52	0/01
Adaptive strategies	-0/05	-0/14	0/02	-2/41	0/01
Non-adaptive strategies	0/14	0/33	0/03	5/54	0/001
On stress by					
Activation system	-12/03	-0/79	4/80	-2/50	0/01
Adaptive strategies	-0/24	-0/61	0/07	-3/28	0/001
Non-adaptive strategies	0/30	0/60	0/08	3/79	0/001

The results of table 2 show that depression (-0.19), anxiety (-0.15) and stress (-0.39) have a significant negative effect and the sleep quality (0.17) has a significant positive effect on the academic performance. Also, the activation system (-0.86) and the compatible strategies (-0.72) have a negative effect and the non-compatible strategies (0.73) have a significant positive effect on depression; the compatible strategies (-0.14) have a negative effect and the inhibition system (0.23) and the non-compatible strategies (0.60) have a positive effect on anxiety, as well as the activation system (-0.79) and the compatible strategies (-0.61) have a negative effect and non-compatible strategies (0.60) have a positive effect on stress.

4. Discussion

The aim of the present study was to test the structural model of the relationships among cerebral behavioral systems, cognitive emotion regulation strategies, mood symptoms and quality of sleep on the academic performance of students of grade 3. The conceptual model test results showed there is a significant relationship between the cerebral behavioral systems, cognitive emotion regulation strategies, mood symptoms and quality of sleep on the one hand and academic performance on the other and the tested model has an appropriate validity. On this basis, one of the findings of present research was a negative relationship between mood disorders (depression symptoms, anxiety and stress) and academic performance. This finding is consistent with the results of the research of (Anbari, 2013; Ghamari, Beygi, Salehi, 2010; Sadeghian, Moghaddari and Gorji, 2010; and Espernak, Skater and Rami, 2006). In this field Ghamari et al (2010) showed that mental health is associated positively with academic performance and students who are of high mental health have better academic performance. In explaining this finding we can point out if the anxiety, depression and stress do not disturb the individual's normal life, it can be considered natural; but if that is higher than the average of population, it is known as mood disorder symptom which can have a negative impact on academic performance (Fathi Ashtiani, 2009). So with high amount of depression, stress and anxiety the individual's focus is directed to solving the problems rather than doing the academic assignments (Sadeghian, Moghaddari and Gorji, 2010). On the other hand, high stress and depression cause to disturb sleep, waking and sleeping hours and disturb person's appetite which is directly of effect on reducing academic performance (Carlson and Holy, 1993).

Other finding of the present research was the impact of sleep quality on the academic performance of students. The positive impact of proper sleep and the negative impact in disrupting sleep on academic performance have been confirmed in researches of (Sobhi, Hajlou, Gholam Zadeh, 2013; Salehi, Dehghani and

Nayyeri, 2009; Ghoreyshi and Aghakhani, 2008; Perez-Chada, Leverett, Videl and Cardinali, 2007; Wolfson and Karskadon, 2003); the present research finding is consistent with these researches. In this regard, Charchio et al (2006) showed that sleepiness and sleep deprivation have a negative impact on learning ability and academic performance of the students. Also the quality and quantity of sleep was significantly associated with the level of the ability and performance of students and also lack of sleep and sleepiness are linked often to decrease in oral and written performance in students. In explaining this finding we can refer to the neurological foundations of sleep. In this regard, Berger (2005) has shown that proper nightly sleep is of effect on regulating life hours and these hours cause some hormone secretions that regulate the biological activity of the body, including the brain's activity throughout the day and make the learning regulation during the day and establishing learning in a period of sleep. Therefore, if the Students do not have a good sleep, their brain and learning system is disturbed and because of lack of focus and the power of memory and learning they will have poor academic performance.

Other finding of the study was the negative relationship of activation system with depression and stress and a positive relationship between anxiety and inhibition system. This finding is consistent with the results of researches of (Alloy, Walsaw, Abramson and Cogswell, 2008; Ahola and Hakanen, 2007; Rich, Wach, Spinat and Karbache, 2014); Hassanvand and Rowshan Chassali, 2013; Tajikzadeh, Fakhri, Sadeghi, Razieh, Mehrabizadeh Honarmand, Mahnaz and Davoudi, Iran, 2015). In this regard, (Alloy, Walsaw, Abramson and Cogswell, 2008) indicated that the anxiety and neurotic depression is a result of great activity of behavioral inhibition system; while major depression is resulted from low activity of behavioral activation system. Also Lauren (2012) showed that the extreme activity of the behavioral inhibition system is usually associated with anxiety disorders. In explaining this finding we can refer to the theoretical foundations of brain/behavioral systems. Gary (2010) points out that the behavioral activation system (BAS) represents the sensitivity to signs of bonus and makes the person to be sensitive to the potential rewards. So failure to receive a reward leads to depression, tension and stress for the person. On the other hand, the behavioral inhibition system (BIS) which is responsible for responding to the signs of punishment and causes sensitivity and avoidance of new and stressful stimuli can lead to anxiety and avoidance of signs of punishment which have been known as the system of anxiety.

Another conceptual model test result was the negative relationship os compatible strategies with depression, anxiety and stress and the positive relationship of the non-compatible strategies with mood disorders. The positive relationship of compatible emotional strategies and the negative relationship of non-compatible emotional strategies with depression, anxiety and stress have been shown in researches of (Abolghasemi, 2011; Yousefi, 2006; Marquin, 2011; Aldao, Nolen-Hoksma, 2010; Klassen, 2010); the results of the present research are consistent with these researches. For example, Yousefi (2006) in his research revealed that the incompatible emotional-cognitive strategies, such as self-blame, rumination, positive reappraisal, catastrophizing and others blame are the most important predicting factors of depression and anxiety. Also, Garnovski, (2005) showed there is a positive correlation between psychological stress and self-blame, others blame, rumination and refocusing on the planning and a negative correlation between psychological stress and the positive attention and positive reappraisal. In explaining this finding we can refer to cognitive emotion regulation function. In this regard, Gratz and Ramer (2004) point out that emotion regulation includes a method in which individuals respond to the emotions themselves (rather than the quality of these emotions). So in respect of having the non-compatible strategies if individuals cannot manage their emotions, they will be exposed to depression and anxiety. In this regard, (Zolomeke and Han, 2010) showed that the cognitive emotion regulation strategies are applied to the individuals' manner of thought after the occurrence of a negative experience or a traumatic event. If the individuals use the compatible strategies in front of the events of life, their anxiety, stress and depression are reduced and they can behave more rationally in front of life issues.

Based on the self-report tool, the present research also like other researches can have some limitations in its generalizations. On the one hand, being limited to the high school undergraduate students of Khorramabad, it

should be careful in generalizing the results of this research. Also based on the findings of the present study the future researchers can investigate the role of moderating variables such as gender and the role of some intermediate variables like self-esteem in the relationships between research variables. On the other hand, due to the negative impact of the sleep quality and mood symptoms on academic performance and a positive impact of cognitive emotion regulation strategies on the academic performance the training professionals can teach cognitive emotion regulation skills as well as the proper sleep techniques to enhance academic performance of students in schools and institutes.

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