Avicenna J Neuro Psycho Physiology. 2016 November; 3(4):e58803. doi: 10.5812/ajnpp.58803.

Published online 2016 November 30. **Review Article**

Study of Comparison Among Information Processing Theory, Interference Model of Test Anxiety and Beck's Cognitive Theory of Depression with Regard to Their Relationship with Academic Achievement

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Received 2016 August 30; **Revised** 2016 September 11; **Accepted** 2016 October 16.

Abstract

Objective: In this paper, the Interference model of test anxiety by Eysenck (1972), Beck's cognitive theory of depression (1967) and information processing theory by Atkinson and Schifrin (1968) were assumed to develop the theoretical framework.
Methods: Here, the above theories are discussed in relation to the present paper. Their application and implications and academic achievement are also considered.
Results: Academic achievement was treated as a dependent variable. Depression and test-anxiety were considered as independent variables, this is because the researcher wanted to investigate whether variables, such as depression, test-anxiety, and memory have the potential to affect students' academic achievement. The paper highlights the relationships between depression, test-anxiety, memory, and academic achievement. It has been postulated that depression and test-anxiety despair short-term memory, and short-term memory cannot transfer information to long term-memory. Thus, these processes are linked to low academic achievement. In other words, when depression and test-anxiety prevent the transfer of information from short-term memory to long-term memory, then students cannot memorize their lesson or recall it.
Conclusions: Although much work has been done on academic achievement, yet there are not enough studies carried out on the relationship among test-anxiety, depression, memory and academic achievement. Thus, more studies are needed to ascertain the effects of depression and test anxiety on academic achievement through memory. The focus of the present paper was to examine the relationship between the above-mentioned variables and theories.

Keywords: Information Processing Theory, Interference Model of Test Anxiety, Beck's Cognitive Theory of Depression and Academic Achievement

1. Introduction

In this paper, three basic theories were used, namely the interference model of test anxiety by Eysenck (1972), Beck's cognitive theory of depression (1977), and Information processing theory by Atkinson and Schifrin (1968) and they were adopted for developing the conceptual framework (1-3). In this section, the above theories were discussed in relation to their application in the present study. Meanwhile, the research theoretical framework is presented in order to support the present work. The three theories are related to academic achievement.

According to Thomas (2005), human processing system consists of 4 principal elements, including eyes, ears, taste buds, and pressure and pain nerves in the skin. These principal elements receive impressions from the environment, stored by short-term memory in a short period of time, while long-term memory stores large amounts of information. Finally, muscle systems, energized by nerve impulses perform all the motor acts, which people carry out, such as reading speaking, running, assembling machines, and the rest (4). The systems involve functions or processes within each element and the interactions among these elements (see Figure 1).

There are 2 main reasons that indicate the mentioned theories are linked together. Firstly, according to Eysenck (2001), Eggen and Kauchok (2004), and Raulin, and Ktkin (2003), depression and test-anxiety are closely related to memory, because students with high depression and test anxiety are unable to concentrate (5-7). For example, Beck (1967) and Halgin Krauss, and Bourene (2005) pointed out that depression symptoms, which affect low academic achievement could lack concentration and attention (8, 9).

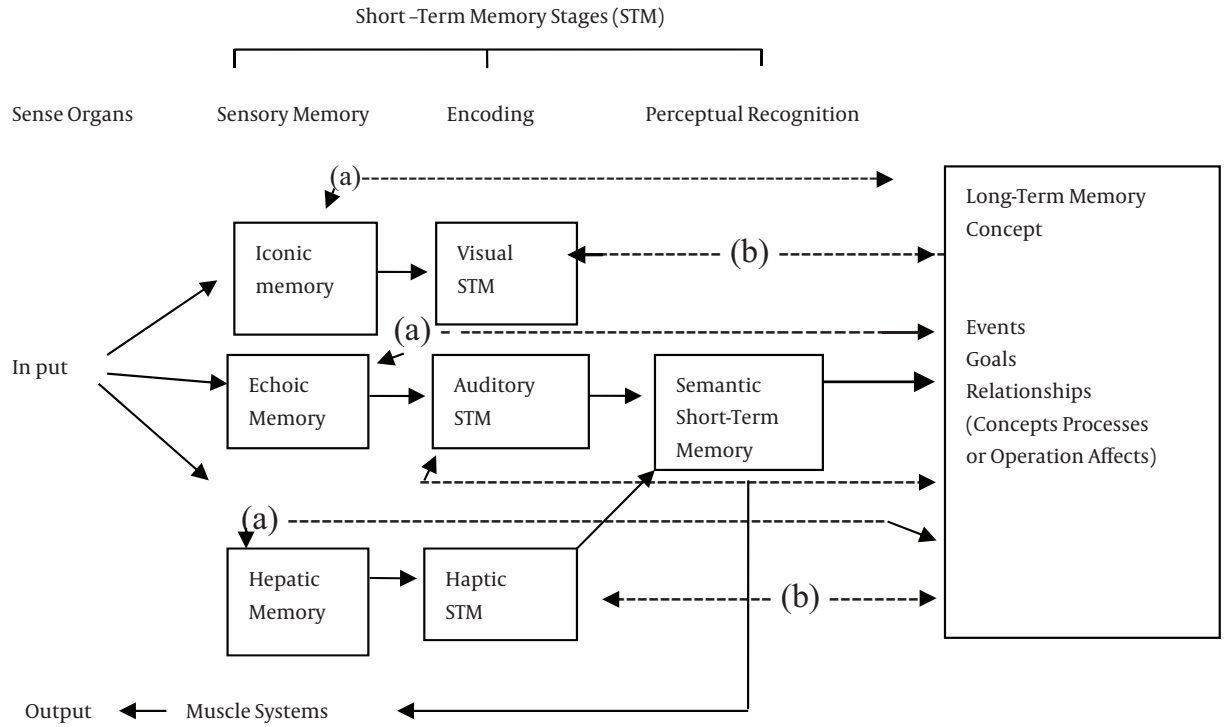

Figure 1. One Classical Version of the Human Information -Processing System (4)

For instance, students, who suffer from depression usually could not pay attention to their study, and thus, it could lead to low academic achievement. Meanwhile, Winter and Bowers (2007), Moritz, Kloss, Jahn, Schick and Hand (2003), Lemstra, Neudorf, Aecy, Kunst, Warren and Bennett (2008), and Chapel Blanding and Silverstein (2005) showed that symptoms of depression, such as inability in concentration and attention, are closely related to memory performance and academic achievement (10-13). In addition, based on the present study, among 21 items of BDI, the highest rate of depression items with triple choice among high school students were "dislike of self" with 23.3%, "self-accusation" with 23.3%, and "sadness" with 14.5 %. However, the lowest scored depression items among respondents were "suicidal ideation" with 2.8%, "pessimism and change in body image" with 4%, respectively.

As mentioned earlier, two items, namely "dislike of self" and "self-accusation" and also "sadness" were highlighted among the other items in BDI, this is closely supported by Beck's cognitive theory of depression. Beck (1967) indicated that dislike of self and self-accusation lead to symptoms of depression, such as sadness and unhappiness (8). Also, low academic achievement and dropout among high school students create dislike of self, self-accusation and sadness meaning that they thought worthlessness because of failure in exam and academic achievement (14). Therefore, it is linked to information processing theory and also to interference model of test anxiety proposed by Eysenck (2001); these three theories have focused on memory and academic achievement, meaning that disruption in attention and concentration leads to dysfunction of memory and leads to low academic achievement (5).

Strauss, Lahey, and Jacobsen (1982) in their study, pointed out that, Beck cognitive theory of depression supports the relationship between depression and academic achievement. They showed that depression interferes with academic success, such as indolence, short attention, preoccupation toward their problems, and poor school performance. Thus, depression decreases academic achievement (15). A study by Salami (2008) also indicated that depression is related to academic achievement and memory, where impairment of attention and concentration lead to low academic achievement. As mentioned earlier, depression influences memory, and information processing theory clearly explains how depression and test anxiety could impair memory capacity (16).

According to the information processing theory, information is not transferred from short-term memory to long-term memory. Secondly, students with high depres-

sion and test-anxiety could not memorize their lesson and recall it (4). Obviously, based on Beck's cognitive theory of depression and interference model of test anxiety by Eysenck, the symptoms of depression and test-anxiety, such as low self esteem, low self-worth, feeling lack of control, negative emotion, anxiety, loss of motivation, anger and negative thoughts, inability in attention, and concentration are related to each other, and they are all associated with weak memory performance (8). Moreover, weakened memory is related to academic failure (17). In short, all discussed theories are related to each other, and thus they need to be considered, particularly, in designing the theoretical and conceptual framework in this study (see Figure 2).

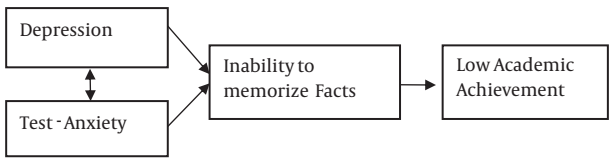

Figure 2. The Theoretical Framework

2.1. Relationship Between Depression, Test-Anxiety, Memory and Academic Achievement

Depression is one of the major mental disorders, which have a wide range of symptoms affecting somatic, cognitive, affective, and social processes. The array of consequences of depression include low academic achievement, poor peer relations, behavioral problems, conflict with parents and authority figure, and low self-esteem (12).

Another issue, presented here, is test-anxiety. According to Zeidner (1998), test anxiety is a multidimensional sign that could be described as "a group of phenomenological, physiological, and behavioral reactions to appear with possible negative consequences or failure on an exam or similar evaluative situation (18). Test-anxiety and depression are also related to memory. Memory is the process by which information is retained for later use (19). Also, based on the information processing model, memory is a storage system that records information from the senses for up to three seconds (4).

As mentioned earlier, depression, test-anxiety, and memory are inter-related and together they may influence academic achievement. According to Pine et al. (2004), Park, Goodyer and Teasdale (2002), and Mowla et al. (2007), depression influences memory. Based on Beck's cognitive theory of depression (1967), negative view about self, future and the world leads to low self-esteem, hopelessness and the belief that the world is unfair (20-22). Also, Beck (1974) and Halgin et al. (2005) showed that negative thoughts lead to depression and effect memory and academic achievement because students with depression cannot do their homework and school activities. It has been noted that the symptoms of depression impair concentration and attention. Therefore, they damage memory. Finally, this leads to low academic achievement (9, 17). Furthermore, Keogh et al. (2003) reported that worrying impairs performance by reducing attainable working memory, which is related to academic achievement (23).

As mentioned above, the major problems of respondents toward exams were worrying and body trembles at the time of exam. These were confirmed by Stober (2004), who indicated that the main components of test-anxiety are worrying about the consequences of failure, and then the perception of autonomic reactions evoked by the test situation, meaning that when students are worried about their test, at the same time their autonomic system will be stimulated and cause depression, and test-anxiety leads to the inability to memorize facts and thus low academic achievement. Signs of test-anxiety include faster heart beats, agitation, glands perspiring and palpitation. Also, those symptoms disrupt attention and concentration and finally lead to low academic achievement among students (24). In addition, test-anxiety decreases academic performance (24). Eysenck (2001) found that limitation in working memory is the cause of cognitive impairment of highly test-anxious individuals. Students with high test anxiety encountered task-irrelevant thoughts, such as worries and anxiety about self-evaluative aspects of failure, which engage working memory. Test-anxiety also disturbs the recall of prior learning and thus reduces academic performance (5). Based on Eysenck's interference model of test anxiety, high test anxiety is closely related to memory and academic achievement. Eysenck (2001) found that high test-anxiety creates irrelevant thoughts, thus impacts on memory and attention span, and leads to decreasing amount of recall (5).

2.2. Depression, Test-Anxiety, Memory and Academic Achievement

According to Peelo and Wareham (2002), low academic achievement has a multitude of causes and many factors affect academic achievement. One of the important factors, which influence academic achievement is test anxiety (25). Zeidner (1998), Hill, and Wigfield (1984) reported that test- anxiety is related to lowering academic performance and it has been estimated that about 25% of American primary and secondary school students, and around 10 million American students experience lower academic performance due to test anxiety (18, 26).

In addition, Chapell at al. (2005) carried out a study on 5551 undergraduate and graduate students in Pennsylvania and Illinois. They found that there was a significant relationship between academic achievement and levels of test-anxiety among students. For instance, students with low test-anxiety had higher academic achievement than students with moderate and higher test-anxiety. Similarly, students with moderate test-anxiety had higher academic achievement than students with higher test-anxiety (13). Also, based on the findings of the study by Chapell et al. (2005), test-anxiety among female students was more than that of male students (13). According to Eysenck's interference model of test anxiety, high test anxiety is closely related to memory and academic achievement. Eysenck (2001) found that high test anxiety creates irrelevant thoughts, it also effects memory and attention span, and then leads to reduced ability to recall (5). To illustrate this process with an example, when an adolescent focuses seriously (anxiety) on outcome or results of a test that they has taken, this might affect their memory, and as a result they would fail the test due to disturbed memory. In this case, they focus more on negative consequences of failure, and this will affect their concentration, attention and then, memory, therefore this would lead to low academic achievement. Eysenck (2001) showed that test anxiety has an impact on memory, which leads to low academic achievement. He concluded that test anxiety is related to less efficient performance because of a vulnerability to distraction and interference (5). Also, test anxiety creates the students' physiological, cognitive and behavioral responses, and these have symptoms, such as palpitations, sweating, fear, apprehension, negative thoughts and feelings about the failure of the test (26, 27). However, Alting and Markam (1993) showed that students with test-anxiety were not only generally more emotionally sensitive to distraction, but also to anxious mood (28). As noted, this theory is closely related to Beck's cognitive theory of depression, where depression and test-anxiety effect attention and concentration (8).

Another factor affecting academic achievement is depression. According to Chen and Li (2000), adolescents with depression were vulnerable to educational under-achievement (29). Based on the resource allocation model of the effect of depressed mood on cognition, students with symptoms of depression are predisposed to focus their attention on interfering, irrelevant thought, leaving little sustained attention available for cognitive tasks, which leads to low academic achievement (30).

Also, Needham (2006) reported that many of the homework depended on the ability to sustain attention and concentration (31). Depression disrupts concentration and attention in schools and most likely undermines academic performance. He indicates that depressed mood is related to academic under-achievement (30). In addition, Rockhill et al. (2008) in their study with 521 middle schools in the USA, found that depression has an impact on academic achievement among respondents because it disrupts attention and concentration, and thus students cannot memorize the information and recall it (31). Frojd et al. (2008) in their research about the relationship between different levels of depression and academic achievement among 2516 students aged 13 to 17 years old in Finland found that depression is related to academic achievement. Depression was significantly correlated with academic achievement among high school students in this study (14).

Studies by Frojd et al. (2008) and Needham (2006) are similar because both of them focused on the relationship between depression symptoms and low academic achievement (14, 30). For instance, Frojd et al. (2006) indicated that depression in high school students has a tendency to impact academic achievement and outcomes. They pointed out that depression caused impaired ability to concentrate, loss of interest, poor initiative, psychomotor retardation, and low self-esteem. These symptoms decrease students' academic achievement (14). Also, Needham (2006) found that depression effects concentration and student's academic performance, which leads to academic under-achievement. In addition, he pointed out that depression symptoms in adolescents are positively associated with failure to complete high school and failure to enter college among high school students (30).

Studies, by Hallfors et al. (2005) in the USA, and Rockville (2005) in his national survey on drug use and health in research Triangle Park, North Carolina have been carried out about depression and its relationship with academic achievement. All of these studies indicated that depression symptoms undermine academic performance (31, 32).

In addition, Beck (1988) argued that the negative schemas developed during childhood could interact with the typical setbacks that most people experience in adulthood to form a negative thought. They pointed out that depression symptoms, such as headache, sleep disorder, anorexia, despair, fatigue, lack of concentration and attention, lack of interest in life, destruction, severe disability in group activities, and isolation have an impact on academic achievement. For example, students, who suffer from depression, usually cannot pay attention to their study, and thus, this could lead to low academic achievement (33). Meanwhile, Winter and Bowers (2007), Moritz et al. (2003), Lemstra et al. (2008), and Chapell, et al. (2005) showed that symptoms of depression such as inability in concentration and attention, lack of energy, negative thought, low self es-

teem, low self concept, anxiety, phobias, withdrawal, disturbed sleep, and appetitive indecisiveness are closely related to memory performance and academic achievement (10-13).

Strauss et al. (1982) in their article entitled "the relationship of three measures of child depression with academic underachievement" pointed out that cognitive theory could support the relationship between depression and academic achievement. They showed that depression interferes with academic success, such as indolence, short attention, preoccupation, and poor school performance. Thus, depression decreases the academic achievement (15). A study by Salami (2008) also indicated that depression is related to academic achievement and memory, where it impairs attention and concentration that lead to academic failure (16). Frojd et al. (2008) reported that depression impairs cognitive functioning and blocks cognitive sources. This is in accordance with Beck's cognitive theory of depression, in which cognitive functioning, attention and concentration are impaired, and short-term memory cannot transfer information to long-term memory, thus students cannot memorize their lesson and recall it (14).

On the other hand, based on Eysenck's interference model of test anxiety, high test anxiety leads to cognitive impairment. This results in lower performance scores on attention and memory, and decreases the academic achievement (1). In addition, Macleod and Donnellan (1993) pointed out that more than 20 experimental studies showed that test-anxiety was linked to academic achievement and also cognitive tasks (34).

Another point to note is that depression and anxiety affects memory. To elaborate this process, information processing theory is employed to explain the effect of depression and test-anxiety on memory. According to this theory, when concentration and attention are impaired, short-term memory could not transfer information to long-term memory (3).

According to the Information Processing Theory, memory is a mediating variable (Atkinson and Schifrin, 1968). Concentration and attention are required in order to transfer information from short-term memory to long-term memory (35, 36). However, if depression and test-anxiety upset attention and concentration, the process of transferring information will be disrupted (4). The disruption of memory could lead to low academic achievement. Thus, in this process, memory is the mediating variable between independent variables (depression and test anxiety) and dependent variable (academic achievement). In addition, according to Eysenck (1992), limitation in working memory is a cause of cognitive impairment of highly test-anxious individuals. In other words, test-anxiety affects attention and concentration, and then, it leads to impairment of memory. In fact, students with high test anxiety have encountered task-irrelevant thoughts, such as worries and anxiety about self-evaluative aspects of failure, which engages working memory (37). According to this interference model, test anxiety disturbs the recollection of prior learning and thus, reduces academic performance (1).

Also, According to Martin (2008), information processing theory describes how the memory system works and how it is related to learning and academic achievement. He indicated that many students have significant problems on interference in transformation of information from short-term memory to long-term memory. This means that some factors, such as depression and test anxiety disrupt the process of learning (36). In addition, according to information processing theory, memory and learning are linked together in three stages, which are sensory memory, short-term memory, and long-term-memory and new information and learning happen in these stages before being stored (35).

Therefore, depression and anxiety prevent the transfer of information from short-term memory to long-term memory and disrupt in the process. In other words, for transfer of information from short-term memory to long-term memory, students must focus attention and concentration on their study. At this stage, depression and test-anxiety disrupt this process, and in this condition, memory is impaired due to inability to memorize and recall the information (6, 7).

As a result, according to information processing theory, firstly, information is not transferred from short-term memory to long term memory. Second, students with high depression and test- anxiety cannot memorize and recollect their lessons (4). Obviously, based on Beck's cognitive theory of depression and Interference model of test anxiety by Eysenck, the symptoms of depression and test-anxiety, such as low self-esteem, low self-worth, feeling lack of control, negative emotion, anxiety, loss of motivation, anger and negative thoughts, inability in attention and concentration are related to each other (1, 2). Also, they are associated with weak memory performance and the weakened memory is related to academic achievement (1, 2). In short, all theories discussed are related to each other, and thus they need to be considered in designing the theoretical and conceptual framework of this study.

In addition, data from the present paper supported findings of studies by Fossati et al. (2002), Rohling and Scogin (1993), An de Decker et al. (2003), Moritz et al. (2003), Afshar (2004), Torzandjani (2006) and Vasa Roberson-Nay et al. (2007). They explained that mental disorders, such as depression and test-anxiety effect memory performance. These studies were carried out in different countries with dissimilar cultures and samples (11, 38-42)

However, all of them pointed out that psychological disturbances have impacts on memory. These findings are in line with the Information Processing Theory (4, 43). As mentioned earlier, depression and test-anxiety effect attention and concentration, and lead to impairment of memory performance. In addition, Torzandjani (2006) reported that subscales of WMS, such as mind control, visual memory, and learning of association in depressed people, are different from normal groups, i.e. depression has impacts on subscales of WMS (44). Furthermore, Vasa et al. (2007) indicated that gender, age, and family social class were not related to either visual or verbal memory (42). In addition, they found that there was a significant difference in visual memory between juvenile and without current test-anxiety groups ($F(1, 50) = 510.24$, $P \leq 5.02$), with lower memory scores observed among adolescents with test-anxiety versus those without test-anxiety ($M = 58.51$ and $M = 9.68$), respectively (42).

An de Decker et al. (2003) pointed out that depression has a considerable relationship with memory deficits. They indicated that depression, anxiety, worry, hopelessness, and subjective stress, are significantly related to the retrieval of specific memories (40). Pine et al. (2004) in their study with 152 respondents (ages 9 to 19) in the USA indicated that there was a significant relationship between memory performance and academic achievement. Also, they showed that there was a close relationship ($F(2,351) = 3.3$, $P < 0.05$) between memory performance and major depression (20). Furthermore, Park et al. (2002) in their study with 75 adolescents in the UK, found that depression had an impact on memory among adolescents (21).

Mowla et al. (2007) reported that memory performance, which was assessed by Wechsler Memory Scale, is related to depression among respondents in Shiraz, Iran. Individuals with depression had lower scores on the Wechsler Memory Scale than the control group (22).

Although, the above-mentioned studies were carried out among different cultures and samples, they were supported by the information processing theory (21, 22). It has been hypothesized that psychological disorders, such as depression and test-anxiety, weaken the attention and concentration of the students and they effect memory and eventually decrease the academic performance of students (21, 22).

Age Diseth (2007) in his study with 206 undergraduate psychology students in Norway, indicated that several factors, such as anxiety, depression and memory, are related to academic achievement (45).

Also, Annett et al. (2007) with 939 children aged 6 to 12 years old without neuropsychological problems from the USA found that memory was closely related to academic achievement (46).

Wilding et al. (2007) in their study with 90 undergraduate students from the UK found that there were significant correlations between working memory and second year examination performance among respondents (47). Kamali, Birdshot, and Ebrahimi (2006) pointed out that cognitive performance, especially learning and academic achievement, was investigated by subscales of WMS (48). Moreover, Airaksinen et al. (2006) reported that depression heavily impacts memory performance among respondents (49).

As mentioned earlier, depression and anxiety prevent the transfer of information from short-term memory to long-term memory. In other words, for transformation of information from short-term memory to long-term memory, students must focus attention and concentration. At this stage, depression and test-anxiety disrupt the process, and therefore, memory is impaired due to inability to memorize and recall the information (6, 7).

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