Research Paper | Psychology | E-ISSN : 2454-9916 | Volume : 2 | Issue : 1 | Jan 2016

COGNITIVE AND CULTURAL ASPECTS OF ACADEMIC STRESS: A REVIEW

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ABSTRACT

Rapid developments in the field of science and technology have made the world more competitive. This competitiveness has made student life more stressful. Stressful academics have a direct impact on cognitive impairment, however there has not been an extensive amount of empirical studies documenting this phenomenon. The Indian education system is known to impart lot of stress among students. A thorough literature search has shown that superstitious beliefs can act as a moderator in some situations while in others an inverse relationship was found. Thus, the present paper encompasses the previous literature conducted till date on cognitive deficits and superstitious beliefs related to academic stress across the globe, focusing more on Indian studies. An extensive literature search with keywords academic stress, coping strategies and superstition has yielded many studies. These articles were collected mainly from online databases EBSCO and ProQuest. The critical issues for future research have been identified and discussed based on the shortcomings from previous literature.

KEYWORDS: academic stress, cognition, superstitious beliefs, and coping mechanism.

"Sometimes when people are under stress, they hate to think, and it's the time when they most need to think." – ***William J. Clinton***

Due to the effect of urbanization and globalization the people have become busier and, therefore, stress is a natural consequence with no exemption on a student's life. "Stress is a lifestyle crisis" (Masih&Gulrez, 2006, p.97) and can be any factor which acts internally or externally that helps the individual to adapt and to maintain the equilibrium (Humphrey, Yow & Bowden, 2000). It affects thoughts, feelings and finally behavior in total. Excess stress causes problems and discomfort irrespective of age. Specifically, students face stress due to their academics during the phase of formal professional education. Thus, stress has become an important topic in academic circles which has led many scholars to explore about the phenomena (Agolla, 2009; Nandamuri & Ch, 2011).

Academic stress

Academic stress can be explained as the student's cognitive appraisal of academic-related stressors, interactions between environmental stressors and the psychological or physiological responses to these stressors (Lee & Larson, 2000). It has been identified as a pervasive problem across countries, cultures, and ethnic groups (Wong, Wong & Scott, 2006). The prevalence rate of academic stress varies from 13% to 45% across cities in India based on the studies conducted after 2000 (Arun & Chavan, 2009; Bansal, Goyal & Srivastava, 2009; Chhabra & Sodhi, 2011; Mishra & Sharma, 2001; Sahoo & Khess, 2010; Salunkhe, Sutrawe, Goel & Jadhav, 2011).

Stress has a direct link with immune system; chronic stress suppresses various immune system parameters. It has also been found that acute system also has an impact in immune functioning (McEwen, 2000). Specifically, it can trigger the production of immune system responses in the absence of an infectious agent (Nguyen,Deak, Owens, Kohno, Fleshner, Watkins & Maier, 1998). Immune deficiency due to chronic exposure to stressors cause many physiological problems which includes heart and bowel disease, herpes, headaches and sleep difficulties (Glanz& Schwartz, 2008; Sanderson, 2012). Poor immune functioning makes them prone to illness, which reduces their ability to strive for excellence leading to reduced outcome. Moreover, there is a cyclical relationship between academic performance and academic stress. Increased stress negatively impacts cognition/immune functioning leading poor academic performance/work efficiency this add on to further stress making it a recurring process (Dusselier, Dunn, Wang, Shelley & Whalen, 2005; Magnussen & Amundson, 2003).

Stressful working atmosphere among students led them to exhibit various behavioral problems like decreased interest in academics, frequent school refusal, irritability, weeping spells and physical complaints due to stress (Chan, Hung, Pin, &Ithnin, 1999; Deb, Strodl& Sun, 2015; Rangaswamy, 1982; Verma, Sharma, & Larson, 2002). Excessive negative stress leads to reduced work efficiency which can be one of the main contributors to increase in addictions and substance abuse and other maladaptive behaviors like crime, absenteeism and school dropout (Dusselier et al., 2005; Glanz& Schwartz, 2008). It was also found that academic stress act as a predictor of suicidal rates among adolescents (Arun & Chavan, 2009; Martin, Richardson, Bergen, Roeger & Allisons, 2005; Wilbum & Smith, 2005).

Academic stress, brain and cognition

Academic learning relies on various brain structures related to memory. Stress responses and the increased cortisol level influence memory and its components. Its effects on cognition vary, especially depending on the amount and frequency of stress present. Acute stress has been found to improve some aspects of cognition, specifically those related to the hippocampus or amygdala (Arnsten, 2009; Henkens et al. 2009; Pestonjee& Pandey, 2013; McEwen &Sapolsky, 1995).

Stress can activate a sort of neural and mnemonic filtering for non-task specific irrelevant sensory information, allowing the individual more selective attentional focus. This noise reduction relegates less information to the hippocampus suggesting less informational interference (Henckens, Hermans, Pu, Joëls&Fernández, 2009). Under the optimum stress level, attention becomes more selective for exclusive focus on the task (Braunstein-Bercovitz, 2003; Chajut&Algom, 2003). Meanwhile, other research refuted this theory claiming stress impairs the neural filtering of irrelevant information (McEwen & Sapolsky, 1995; Wolkowitz, Reus, Weingartner, Thompson & Breier, 1990; Skosnik, Chatterton, Swisher & Park, 2000) leading to difficulty accessing task-specific information and an increasing availability of continual, arbitrary, non-task-specific information (Pestonjee & Pandey, 2013).

The hippocampus is the storage center for long-term memory and declarative memory. Hippocampal long-term potentiation (LTP) is associated with some types of memory formation and retrieval (Purves et al., 2001). Based on the knowledge that stress causes hippocampal LTP deficits, Baker and Kim (2002) found that stress affected the synaptic plasticity of the hippocampus, causing non-spatial hippocampal object recognition after five minutes but deficits after a three-hour delay. High levels of hypothalamus-pituitary axis activation due to high stress impairs memory consolidation (Abercrombie, Kalin, Thurow, Rosenkranz & Davidson, 2003; Erickson, Drevets & Schulkin, 2003). Under stress, impairments to declarative memory are present whereas procedural memory, the knowledge of how to do tasks, remains relatively untouched; perhaps because procedural memory occurs in brain structures separate from the hippocampus. Chronic stress has even been found to cause hippocampal shrinkage and neuron damage (McEwen & Sapolsky, 1995). Cognitive deficits like impairment in memory and attention have a negative impact on performance, which further adds on to the students stress levels (Lazarus, Deese & Osler, 1952).

The prefrontal cortex is responsible for judgment, decision-making, response inhibition, cognitive flexibility, and emotional regulation with specific parts of the cortex involved in short-term and working memory functioning and long-term memory retrieval (Euston, et al., 2012, Lyons, et al. 2000). Working memory functioning occurs within a substrate of the prefrontal cortex (PFC). Consistent neural activity indicates that dorsolateral PFC acts as a storage center for temporary retention and maintenance of pertinent information (Curtis &D'Esposito, 2003). Studies done on animals and humans have evidenced stress-induced working memory and spatial working memory impairments (Mika, Mazur, Hoffman, Talboom, Bimonte-Nelson, Sanabria & Conrad, 2012; Beilock & Carr, 2005; Schoofs, Preuß & Wolf, 2008; Buchanan, Tranel, & Adolphs, 2006; de Quervain, Roozendaal, Nitsch, McGaugh, & Hock, 2000). This can be attributed to the fact that stress causes a decrease in PFC functioning (Yuen, et al, 2012; Seehagen, et al, 2015; Birnbaum, et al, 1999), subsequently leading to an increase in amygdala and hippocampal functioning (Arnsten, 2009, Leuthi, et al., 2009, McGaugh and Roozendaal, 2002), to an extent.

Working memory becomes impaired when the task load is high (Lupien, Gillin, & Hauge, 1999) and when the performance is evaluated during a stressful event (Elzinga & Roelofs, 2005). Mika et al. (2012) studied stressed rats and found impaired response inhibition and delayed gratification. They also found that chronically stressed rats committed more spatial working memory errors than their counterpart control rats. Beilock and Carr (2005) investigated why high-powered people seem to fail in stressful conditions such as during math problem solving. They found that stressed individuals with high working memory capacity showed problem-solving impairments compared to their average working memory capacity counterparts who did not. Under stress, decision-making is also affected; individuals have been found to make hastier decisions without thoroughly reviewing all the options (Pestonjee and Pandey, 2013).

The amygdala plays a role in influencing long-term memory formation related to emotionally arousing experiences. Supposedly, the amygdala functions in accordance with endogenous stress hormones, which release during emotional incidents or episodes and modulate the storage of memory (Cahill, et al., 1996). Kuhlmann, Piel and Wolf (2005) found that stress causes delayed retrieval impairments of emotional arousing stimuli. Yet according to Mc Gaugh and Roozendahl (2002), adrenal stress and glucocorticoids can enhance memory consolidation and help form lasting memories. Luethi, Meier and Sandi (2009) found stress enhanced hippocampal spatial explicit memory and classical conditioning of negative stimuli. Research has also shown that participants given an emotionally loaded story tend to remember the emotionally related central details better, while those given neutral stories remembered the peripheral details better (Pestonjee & Pandey, 2013; McEwen & Sapolsky, 1995; Cahill, Prins, Weber, & Mc Gaugh, 1994).

Adrenocortical hormones are involved in memory formation. Glucocortiocoids, an adrenocortical hormone, have been found to "impair short-term retention performance" as well as cause memory retrieval deficits (Roozendaal, Hahn, Nathan, de Quervain & McGaugh, 2004, pg. 8161). Therefore, one explanation for the deficits in delayed memory retrieval could be attributed to psychosocial stress causing stronger adrenergic activation, which is spurred by glucocorticoid interplay with hippocampal and amygdala adrenergic mechanisms leading to impairments in memory retrieval (Roozendaal, Hahn, Nathan, Dominique & McGaugh, 2004; Kuhlmann, Piel & Wolf, 2005). Kuhlmann, Piel and Wolf (2005) also found memory retrieval deficits for the emotionally arousing words over the neutral ones. Thus supporting the idea that the amygdala is linked to "memory formation of arousing stimuli" (Kuhlmann, Piel & Wolf, 2005) and memory recall of emotionally arousing events by being relevant during the encoding process (Roozendaal, Hahn, Nathan, Dominique & McGaugh, 2004).

One explanation for the why stress enhances hippocampal and amygdala functioning can be attributed to a stress-induced increase in catecholamines, a group of neuromodulaters: dopamine, norepinerpherine and epinephrine. These weaken PFC functioning and strengthen hippocampal and amygdala functioning creating "a vicious cycle" (Arnsten, 2009, pg. 413). This increase in catecholamines can also lead to strengthened fear conditioning coming from the amygdala. This weakens the PFC working memory and attention regulation abilities, causing an annihilation of top-down logical reasoning though tasks and replacing it with bottom-up reasoning controlled by the sensory cortices. The PFC also has connections with various parts of the brain such as the amygdala, allowing the PFC to regulate emotional responses (Arnsten, 2009). When PFC regulation is weakened, this enhances our attention direction toward brightly colored or moving stimuli instead of the information pertinent to the current task. Subsequently, declarative memory associated with the hippocampus is enhanced through association with the catecholamine stimulation of the amygdala. With our amygdala more in control, we are governed more by habitual basic emotionally regulated responses instead of the logical, rationality of the PFC (Arnsten, 2009; Arnsten, 1998).

Mizoguchi, Yuzurihara, Ishige, Sasaki, Chui and Tabira (2000) attributes the spatial working memory deficits to a dysfunction in dopaminergic transmission. Based off the research claiming that decreased dopaminergic transmission located in the prefrontal cortex causes working memory impairments in neuropsychiatric disorders, Mizoguchi et al. (2000) studied the influence of stress on the prefrontal cortex and spatial working memory. Previous research indicated that acute stress caused hyperdopaminergic activity, an increase in dopamine, whereas their study found chronic stress caused the opposite, hypodopaminergic activity, a decrease in dopamine production (Mizoguchi et al., 2000). Dopamine and serotonin play a significant role in regulating learning

and memory functioning. Synaptic modifications at dendritic spines are tied the codification of mnemonic information, related to memory formation. The "modulatory influence" of dopamine and serotonin is believed to affect this codification process (Gonzalez-Burgos & Feria-Velasco, 2008). Dopamine is also known to modulate and regulate the hippocampus. It stimulates 'adaptive memory,' memory utilized for adaptive behavior, by keeping those memories pertinent and accessible for future use (Shohamy& Adcock, 2010). Therefore, an increase in dopamine during acute stress benefits hippocampal functioning. These findings show more or less than the optimal amount of dopamine negatively affects the prefrontal cortex.

It can be concluded from the studies that stressful academics reduce working memory (Buchanan, Tranel & Adolphs, 2006; de Quervain, Roozendaal, Nitsch, McGaugh, & Hock, 2000), attention (Skosnik, Chatterton, Swisher, Park, 2000) and concentration (Chan, Hung, Pin, & Ithnin, 1999; Skosnik, Chatterton, Swisher, Park, 2000) resulting in poor academic performance and work efficiency (American College Health Association, 2009; Cave, 2011; Chow, 2007; Chung & Cheung, 2008; Dusselier et al., 2005; Flook&Fuligini, 2008; Richardson, Abraham, & Bond, 2012; Taylor, Vatthauer, Ruggero& Roan, 2013). Studies have shown that stress can have both positive and negative consequences on cognitive functioning. As evidenced by the presented research, many studies contradict each other on what the exact effect of stress on various cognitive functions are. More research must be done for more absolute conclusions to be made.

Superstition

Damisch, Stoberock & Mussweiler (2010) has defined superstition as an irrational belief that an individual can have towards an object, action or event that is not logically related to the task or the outcomes of the event. Superstitions has been imbedded in the functioning of societies for a long time and has had its impact on how people live and behave. These thoughts and behaviors are typically done for good luck; a practice where people do certain rituals without questioning its existence or whence it came from (Dean, 2013).

Over the years of studies in this area, it has been found that the presence of superstition and related aspects is more prevalent than what the general population normally might perceive. In the Indian context, it has been found that urban people tend to be more superstitious than those from the rural background, and that women tend to be more superstitious than men (George & Sreedhar, 2006). In the context of performance, there is a tendency among subjects who are evaluated by their performance, like students and athletes, to have superstitions (Albas & Albas, 1989). Indian culture is bound by many superstitions based on religion, old stories, legends, fortune telling and personal situations (Fukui, Endoh, Rahman, &Maekawa, 1998). During the process of upbringing, the newer generations learn superstitious beliefs through conditioning. Mothers surrounded by so many adversities without proper training and education are victims of superstitious beliefs in India (Bansal, Dixit, Waskel, Mahore, Mishra, &Rokde, 2015). Indian people are tightly locked up with religious taboos leading to certain practices (Bukhari et al., 2002).

Positive and negative effects of superstitions

Various studies have found various effects of superstition. Albas & Albas (1989) found that individuals would rather be in command of their destinies rather than succumbing to the fate of omens. So they would involve themselves in certain rituals that would help them believe that they are able to control the outcome of their task. Thus the nature of the individual's uncertainty affect the probability of superstition, but that the nature of these effects depends on the individual's prior beliefs (Abbott & Sherratt, 2011).

People who express a preference for these lucky products form an illusion of control over future outcomes. They perceive superstitious behaviors to be an effective strategy to achieve the desired result (Hamerman & Johar, 2013). Increased task persistence constitutes one means by which self-efficacy, enhanced by superstition, improves performance (Damisch, Stoberock & Mussweiler, 2010). What is countering these positive aspects of superstition is an irrational belief pattern that is present in the behavior of the individuals. George and Sreedhar (2006) saw that if people are not prepared to think beyond their irrational belief patterns, then the concept of globalization would be a Herculean task.

Looking into the literature on this concept, one of the theories that stands out is Malinowski's "Theory of the Gap'. The theory looks into how there seems to be feeling of void in the individual when they come to face something that is unknown-which can cause some form of stress- and this feeling of void causes anxiety- some situations containing unpredictability and uncertainty. The stress that an individual goes through can be seen as a place of void and the theory claims that superstition and related rituals serve to reduce this anxiety. These rituals form a sort of substitute activity with a suggested anticipation of hope which can be said to be functional are to be found cathartic (as cited in Campbell, 1996).

Superstitions relate to cognitive processes

Religious and superstitious beliefs have been linked to the prefrontal cortex (Del Campo Rios, 2009). Dopamine may play a role in the mediation of superstitious actions (Voland, & Schiefenhövel, 2009). In their book, the authors have referred to the physiological basis of superstition where "proneness to gullibility, belief in paranormal phenomena, and to 'seeing' things…are associated with higher levels of dopamine in the brain" (Voland, & Schiefenhövel, 2009, p. 33). They also saw how superstitions are formed by individuals ascribing causal meaning to two unrelated events, through the process of operant conditioning (Skinner, 1948) which involves dopamine (Johnson, 2011). Thus a higher likeliness of superstition beliefs and behaviors are correlated with higher dopamine levels.

What can be also related to here is the amount of specific neurological functioning that happens in the individual that can be related to the various superstitious behavior of the individual. Dopamine increases one's ability to recognize patterns and find semantic meaning in things. In a study by Krummenacher, Mohr, Haker and Brugger (2010) they found that believers had a certain increase in perceptual-cognitive decision due to the increases in dopamine one's ability to recognize patterns and find semantic meaning in things, while skeptics had a decrease sensitivity in perceptual-cognitive decisions. Therefore, attributing more semantic meaning to things goes hand in hand with finding causal meaning between events and creating and having superstitious beliefs.

Our Assumptions

Due to the lack of empirical research present on the effect of superstition on academic stress, we have had to formulate our own assumptions. It seems that when working memory is negatively affected, it appears that superstitious behaviors may be more likely to occur. When students are uncertain about their performance outcomes, the literature suggests subsequent higher chances of superstitious behaviors. Psychosocial among other acute and chronic stressors increase and/or decrease dopamine production, both causing negative consequences to the prefrontal cortex (Pruessner, Chapagne, Meaney&Dagher, 2004; Mizoguchi, et al, 2000; Arnsten, 2009). Therefore, under chronic stress, we assume that superstitions act to increase the dopamine production, thus acting as a moderator during times of stress.

Conclusion

It can be concluded from the studies that stressful academics reduce working memory (Buchanan, Tranel, Adolphs,2006; De Quervain et al, 2000), attention (Skosnik, Chatterton, Swisher, Park, 2000) and concentration (Chan, et al., 1999; Skosnick, et al, 2000) resulting in poor academic performance and work efficiency

(Cave, 2011; Chow, 2007; Chung & Cheung, 2008; Dusselier, Dunn, Wang, Shelley II, & Whalen, 2005; Flook & Fuligini, 2008; Richardson, Abraham, & Bond, 2012; Lee et.al, 2006; Taylor, Vatthauer, Ruggero & Roan, 2013). Studies have shown that stress can have both positive and negative consequences on cognitive functioning. As evidenced by the presented research, many studies contradict each other on what the exact effect of stress on various cognitive functions are. More research must be done for more absolute conclusions to be made.

A limitation present was the lack of literature on the relationship between academic stress and superstition. There were also limited writings on superstitions within the Indian context. More research would provide a clearer picture as to how prevalent superstitions are within the Indian culture and what impacts they have on academics. Future research could be done to fully understand the biological and neurological processes involved in the link between superstition, stress relief, and enhancement of performance. The current literature presents an unclear relationship between these variables.

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