

Mathematical Modeling of Mental Illness and Stress Management: A Review

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Abstract

Stress is an unavoidable part of daily life, and learning how to manage it effectively is essential for living well. Interestingly, mathematics often seen as just a school subject is also deeply woven into our everyday lives. Much like stress, it plays a silent but significant role in how we go about our routines. Given how mathematics influences so many areas of life, it's not a stretch to explore whether it also plays a part in how we understand and manage stress. This review delves into the concept of stress, explores common strategies for managing it, and highlights the often-overlooked role that mathematical thinking can play in that process. From time management and planning to flexibility and organization, many effective stress-management techniques are rooted in logical reasoning, structure, and problem-solving, core skills nurtured through math education. Whether it's through basic numeracy in budgeting time, using logic to organize tasks, or developing awareness and control through structured routines, mathematics contributes in subtle but powerful ways. The review shows that a solid grasp of mathematical concepts isn't just useful in academics or work and it can actually be a valuable tool in helping us navigate stress more calmly and effectively.

Keywords: Mathematical modeling, management, stress, knowledge, skills

INTRODUCTION

Mathematical modeling plays a significant role in our daily lives and has a major impact on both the quality of our personal lives and our professional paths. As point out, having a solid understanding of math is essential for effectively navigating life in today's world. Given its broad relevance across every part of life, it's easy to see how mathematical knowledge could also be helpful in addressing stress. Stress, a constant and universal part of life, affects almost every aspect of our existence. As such, it's a central topic in mental health research and one of the more complex areas of study in psychology and sociology today. According to Esch and Stefano (2010) [10], stress is the body's natural way of responding to both external and internal challenges. It's essentially how we react to changes, and these reactions can be physical, emotional, and mental. If stress isn't managed, it can quickly become harmful (Patal, 2013) [23]. Over time, chronic stress can negatively affect all areas of an individual's life, influencing their well-being and decision-making abilities. Persistent stress is also a key factor in developing more serious mental health issues like anxiety and depression.

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Given the impact stress can have, managing it effectively is essential for leading a healthy, successful life. Stress management involves various strategies and techniques aimed at helping people handle stress in a healthier, more productive way. This review will delve into the nature of stress, its effects, the strategies for managing it, and how knowledge of mathematics can enhance those stress-management skills.

Nature and Importance of Mathematics

Mathematics isn't just something we study in school or college but it's a vital part of everyday life that shapes the world around us. It goes beyond the classroom, supporting personal growth and helping us navigate the challenges of daily living. While there are many ways to define mathematics, its complexity means that there's no single definition everyone agrees on. One definition describes mathematics as a branch of science that focuses on numbers and their relationships, involving calculation, problem-solving, and abstract thinking. Historically, it's evolved through abstract thinking and logical reasoning, with a framework that's exact, systematic, and well-organized (Okafor & Anaduaka, 2013) [20].

Mathematical modeling plays a crucial role in the advancement of society. It is the foundation of much of what we know about the world, driving progress in fields like production, science, and technology. It also helps us understand the laws of nature and the phenomena around us. The way math is used in everyday life is a key reason it's so important. From simple tasks like waking up to an alarm and telling time, to making decisions like which product to buy, the skills we develop from learning math are essential in our daily routines [21,22].

All careers require a foundation of mathematics knowledge and skills. It is applied to various fields like nature, technology, physics, chemistry, life science, accountancy, etc. and it is the basis for scientific and industrial development. Even vocational areas like tailoring and carpentering need mathematics. Its role also extends to recreational activities like playing puzzles, crosswords, basketball, etc. Many complex systems and structures in our modern society can only be understood using mathematics. The study of mathematics also impacts a variety of benefits on the learners, especially at a psychological and intellectual level. Okafor and Anaduaka (2013) [20], state that the study of mathematics goes beyond acquiring computational skills; it also encourages the habits of self-reliance and problem-solving in the learner equipping them with the skillset needed to tackle real-life problems through unique procedures. Because it is a precise subject that cannot be learned through vagueness, it trains and disciplines the mind of the learner. Mathematical knowledge also promotes other psychological benefits like the habit of accuracy, and logical, analytical, and systematic thinking. It assists in better organization of ideas and accurate expression of thoughts. The successful study and understanding of mathematics can also be personally satisfying and empowering. Mathematics is also necessary for the development of infrastructure, largely due to its influence over all forms of engineering. It is used for the construction of roads, stadiums, buildings, flyovers, dams, airports, etc.

Mathematics Knowledge and Skills

The nature of the mathematical body of knowledge is not static but ever-changing. There has been a wide variety of views of what entails mathematics knowledge. Mathematics knowledge does not imply detailed knowledge of complex sophisticated mathematical formulas and equations, etc. but rather a broad understanding and appreciation of what mathematics is capable of achieving. It involves knowing and applying basic mathematics in our everyday living. It states that mathematics knowledge is an individual's capacity to identify and understand the role that mathematics plays in our modern world, to make well-founded judgments, and to use and engage with mathematics in ways that meet the needs of that individual's life. A mathematically knowledgeable individual can estimate and interpret data and use it to solve day-to-day problems, reason in numerical, graphical, and geometric situations, and communicate using mathematics. An important part of mathematics knowledge is using, doing, and recognizing mathematics in a variety of situations. It includes using mathematics to deal with issues that lend themselves to a mathematical treatment. Ernest (2005) [9] highlighted various categories of knowledge to be derived from the study of mathematics. This includes functional numeracy which enhances basic mathematical and numeracy skills adequate for daily living and general employment, practical work-related knowledge improves the ability to solve practical problems especially those centered in industries and work environments with mathematics, advanced specialist knowledge necessary for advanced knowledge for mathematics specialists,

mathematical problem posing and solving essential in deploying mathematical knowledge, skills and powers in solving mathematics problems, mathematics confidence and the appreciation of mathematics as an element of culture, history, and society. Being knowledgeable in mathematics comes with certain skills, that are derived from it. Mathematics skills are intertwined with 21st-century skills. Mathematics skills include; critical thinking and problem solving, collaboration across networks, agility and adaptability, effective communication, accessing and analyzing information, and curiosity and imagination [11].

Stress: Nature and Meaning

Due to its ambiguous and broad nature, the concept of stress has over time been associated with a series of definitions. It is a major topic of interest to various professionals including those from the fields of medicine, social science, psychology, and even zoology. Hans Selye (considered to be the father of stress research), defined stress as a body's non-specific response to demand. describe the concept as a feeling of mental press and tension. Looking further into the concept, stress can be said to be our body's response to any change, threat, or pressure put upon it, whether external or internal. Our body's reaction once faced with a threat or challenge, entails stress. Therefore, it could be said stress is any worrisome response to unexpected or expected demands of everyday living that can impact negatively on the psychological and physiological wellbeing of the individual. Thus, the American Psychiatric Association (2014) [1] states that it influences people in every age, gender, race, and condition, and its impact is capable of being felt in both physical and psychological health, cited a categorization of the definitions of stress into three types; stimuli-based, response-based, and the stressor-strain interaction. The stimulus-based approach views stress as external factors or forces imposing on an individual in a disruptive way. The response-based approach sees stress as an individual's physiological or psychological response to intense situations. The stressor-strain interaction approach draws from the two other category-defining stress as both the stimuli from the environment and the response from the individual [2].

Another perspective for looking at stress is as a state triggered by an imbalance between demands, and our supposed abilities to meet those demands (Geber, 2011 [12]. This paints the picture that events or demands are not in their nature stressful, but the individual's perception interprets them as such. This is mostly associated with situations where there will be major consequences of not meeting those demands. For instance, the inability of a man to care for his family's needs [13-15]. Even a moderate amount of stress has been linked with a lot of behavioral changes including things like loss of happiness, restlessness, irritability, and anger, and so on. It is most time the first stage towards depression UNB Writing Centre (UWC, 2011). There is also growing evidence that distress adversely affects cognitive and emotional processes such as memory, attention, and fear conditioning, and states that stress also influences our decision-making, mostly leading to hyper-vigilant decision making. Such situations in life need to be managed properly among individuals for the peaceful co-existence of humans within society [3].

Stress Management

Stress management techniques can be referred to as self-care practices which are engagements in behaviors that help to maintain and promote physical and emotional health, thus reducing the instances of stress. Kassymova et al (2018) [17] state stress management as a range of processes involving physiological, cognitive, behavioral, or psychological methods, usually applied in combination with each other and utilized in dealing with and abating the presence and the effects of stress. [16] In its most basic form, stress is managed through coping mechanisms/techniques. Coping mechanisms are rote thought patterns or behaviors that reduce or neutralize stressors, or their impact on us (Geber, 2011) [12]. It is our mind and body's natural effort designed to manage stressful situations. Individuals are known by complex coping strategies as part of the socialization and maturation process. It differs widely from one person to another. For example, a man who cannot sustain the financial needs of his immediate home can decide to abandon his wife and children to

another destination unknown to his family. This type of thought comes automatically, as a medium for reducing stress [4].

Highlighted a classification of coping mechanisms into three main categories; problem-focused coping, emotion-focused coping, and avoidance coping. Problem-focused coping involves addressing the problem (e.g. focusing on the next course of action rather than the current situation) [18,19]. Emotion-focused coping involves reducing or managing the emotional response (e.g. focusing on and venting of emotions). Avoidance coping involves avoiding or distracting oneself from the situation (e.g. immersing oneself in work to not think of problems at home). The coping mechanism of any individual is largely influenced by their locus of control [5].

Skills and Techniques in Stress Management

Effective stress management strategies as outlined by various authors include; flexibility, awareness, rest/relaxation, exercise, building an effective social support system, building an internal locus of control, organization/time management, alteration of external factors, nutrition, and dietary changes (Esch & Stefano, 2010) [10]. Flexibility as a stress management technique is closely linked with an individual's attitude and thought process. It involves training the mind to accept change, disappointment, and even failure with genuine composure. It involves developing the mental framework to try again, or try something new, if things don't work out, this largely improves reactions to potential stress situations. Being flexible also involves being able to adapt to stressful situations that cannot be avoided or changed (Patal, 2013) [23]. It includes activities like reframing problems and viewing a stressful situation from a more positive perspective. It also involves taking a larger perspective of the stressful situation, like when stressed out, an individual will be bound to feel better if he questions whether that he would even remember the situation in a month, a year, or five years, or if it would matter by then [6].

Awareness involves understanding and recognizing an individual's cause and reactions to stress. As Patel (2013) [23] noted, stress management starts with identifying the sources of it in an individual's life, as this is necessary if any improvement is to take place. Perhaps an individual is constantly stressed about not meeting deadlines, but it might be the individual procrastination tendencies rather than the job demands, that cause that stress. Awareness also involves receiving preparatory information about the possible stressor. Showed an example of this. He stated that findings from medical studies have shown that when individuals are about to undergo stressful clinical procedures, giving them the appropriate preparatory information about the process, tends to lessen the negative reaction/stress. Preparatory information is hypothesized to work as it renders the stressor well-known, and thus enhances the common sense of an individual's command over the unpleasant incident. The efficacy of preparatory information lies not only in duly informing the individual of the contents of the imminent stressful event but also in providing information about strategies through which persons can cope with the stressor and its effect. A subset of awareness strategy to stress management is the "stress inoculation training". Giga, Cooper, and Faragher (2013) cite it as a potential method of reducing stress response and anxiety, and in enhancing performance under stress, as evidenced by various studies. It is an approach to cognitive-behavioral therapy (CBT) that involves training the individual to acquire useful coping skills, even before being exposed to stress to respond more favorably to stressful events [7].

Mathematics Knowledge and Skills in Stress Management

Considering the applicability of mathematics knowledge and skills to all aspects of life and living, it is only natural that its influences are present in the management of stress. Knowledge of mathematics, and the skills derived from it, influences the various stress management techniques in many ways, and some of them are discussed below; As noted earlier, knowledge of mathematics develops the mind and promotes logical thinking in individuals. Stat-Analytica (2020), states that it supports the development of critical, logical, and analytic thinking and all-around intellectual/mental development. These skills are useful if one is to be flexible and look at problems from a more positive

approach. Logical reasoning and various other cognitive development associated with the knowledge of mathematics also influence an individual's decision-making ability and emotion control to a large extent (Miguel, 2020; Jasper, 2020). Its influence over decisions and emotions, will in turn influence an individual's social relationships and locus of control, which are keys to stress management. Mathematics also trains the mind for problem-solving, through creative, analytical, critical thinking. This skill is useful to help individuals adapt or react effectively to stressful situations (flexibility or altering the external factors). As Stat-Analytica (2020), noted knowledge of mathematics provides us a broader perspective in solving real-life problems, and stress is an integral part of life problems. The development of the mental faculty by mathematics also aids individuals in the awareness approach to stress management. As it leads to better understanding and retention of the individual's stress response and retaining and applying preparatory information to deal with stress [8].

Time management is also used in relaxation to assign a period of relaxation daily amongst others. Plus, sleep under the heading of relaxation has been noted to improve stress management. It has been reported that an individual needs at least 8 hours of sleep daily. With the demands of the modern world, obtaining that amount of sleep all through the night might not be feasible for an individual especially for a student and lecturers, who prefers reading during night time. Being able to manage time, will allow the students and lecturers to calculate and distribute the required hours for sleep throughout the day. Like planning when and how long to take a nap during the day, to make up for a night's lack of rest [9].

CONCLUSION

When it comes to relevance and applicability in daily lives, Mathematics is one of the most indispensable subjects, as its knowledge to a certain extent dictates the flow of daily activities in all areas. Stress is one of such areas, where the influence of mathematics can still be measured. Stress is a major problem in the 21st century, and it has been noted to be increasing and will only keep increasing. Due to the adverse effect of prolonged stress, various stress management techniques have been put forward and promoted. This review explored some of those techniques and the influence of mathematics knowledge over them. The influence of mathematics range from the cognitive development attributed to mathematics, to time management, and everyday numeracy. It is thus shown to be evident that mathematics is crucial and present in the process of managing stress.

Recommendations

Based on this literature, the following recommendations are made:

1. The understanding of mathematics and its applicability to daily lives should be encouraged as an integral part of any mathematics education program.
2. Stress management techniques should be taught in all settings as a precursor to healthy living in this modern day.
3. Stress management intervention programs should promote the learning of stress management from the perspective of mathematics.
4. Individuals should be educated on the importance of mathematics as a stress management tool.

REFERENCES

1. American Psychological Association. Stress in America: Paying with our health [Internet]. Washington, DC: APA; 2015 [cited 2025 May 9]. Available from: <https://www.apa.org/news/press/releases/stress/2014/stress-report.pdf>
2. Bataineh MZ. Academic stress among undergraduate students: the case of education faculty at King Saud University. 2013. *المجلة التربوية الدولية المتخصصة*. Jan;1(1033):1-7.
3. Bernal-Morales B, Rodríguez-Landa JF, Pulido-Criollo F. Impact of anxiety and depression symptoms on scholar performance in high school and university students. In: *A fresh look at anxiety disorders* 2015 Sep 9. IntechOpen.
4. Căprioară D. Problem solving-purpose and means of learning mathematics in school. *Procedia-social and behavioral sciences*. 2015 Jun 2;191:1859-64.

5. Chapman O. Investigating teachers' knowledge for teaching mathematics. *Journal of Mathematics Teacher Education*. 2013 Aug;16(4):237-43.
6. Chrousos GP. Stress and disorders of the stress system. *Nature reviews endocrinology*. 2009 Jul;5(7):374-81.
7. Kovach Clark H, Murdock NL, Koetting K. Predicting burnout and career choice satisfaction in counseling psychology graduate students. *The Counseling Psychologist*. 2009 May;37(4):580-606.
8. Curtis C. WHY DO THEY CHOOSE TO TEACH-AND WHY DO THEY LEAVE? A STUDY OF MIDDLE SCHOOL AND HIGH SCHOOL MATHEMATICS TEACHERS. *Education*. 2012 Jun 1;132(4).
9. Ernest P. Why teach mathematics. *Aust Coll Educ*. 2005. <https://doi.org/10.2307/30215766>
10. Esch T, Stefano GB. The neurobiology of stress management. *Neuroendocrinology letters*. 2010 Jan 1;31(1):19-39.
11. Eshmominova D. THE IMPORTANCE OF USING COMPUTER TECHNOLOGY IN TEACHING MATHEMATICS. *Builders Of The Future*. 2021 Jun 30:47-50.
12. Geber RC. What is stress [Internet]. 2011 [cited 2025 May 9]. Available from: <https://www.pacdeff.com/pdfs/What%20is%20Stress.pdf>
13. Giga SI, Cooper CL, Faragher B. The development of a framework for a comprehensive approach to stress management interventions at work. *International journal of stress management*. 2003 Nov;10(4):280.
14. Granath J, Ingvarsson S, von Thiele U, Lundberg U. Stress management: a randomized study of cognitive behavioural therapy and yoga. *Cognitive behaviour therapy*. 2006 Mar 1;35(1):3-10.
15. Ingersoll R, Merrill L, Stuckey D. Seven trends: The transformation of the teaching force (#RR-80). Consortium for Policy Research in Education Report; 2014.
16. Jasper. How logical reasoning works [Internet]. 2020 [cited 2025 May 9]. Available from: www.braingymmer.com/en/blog/logical-reasoning
17. Kassymova K, Kosherbayeva N, Sangilbayev S, Schachl H. Stress management techniques for students. In *International Conference on the Theory and Practice of Personality Formation in Modern Society (ICTPPFMS 2018)* 2018 Sep (pp. 47-56). Atlantis Press.
18. Kaufman JA. Stress and social support among online doctoral psychology students. *Journal of College Student Psychotherapy*. 2006 Feb 23;20(3):79-88.
19. Kumar M, Sharma S, Gupta S, Vaish S, Misra R. Medical education effect of stress on academic performance in medical students-a cross-sectional study. *Indian J Physiol Pharmacol*. 2014;58(1):81-6.
20. Okafor CF, Anaduaka US. Nigerian school children and mathematics phobia: How the mathematics teacher can help. *American Journal of Educational Research*. 2013;1(7):247-51.
21. Ong L, Linden W, Young S. Stress management: what is it?. *Journal of psychosomatic research*. 2004 Jan 1;56(1):133-7.
22. Pascoe MC, Hetrick SE, Parker AG. The impact of stress on students in secondary school and higher education. *International journal of adolescence and youth*. 2020 Dec 31;25(1):104-12.
23. Patel LA. Stress management. *Int J Res Humanit Soc Sci*. 2013;1(9):30-6.