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Theory-Based Interventions to Reduce Math Anxiety and Enhance Achievement

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ABSTRACT:

Math anxiety undermines students' participation, persistence, and achievement across ages and cultures. This paper synthesizes theory-based interventions that target both emotion and learning processes. Three frameworks organize the review: cognitive-behavioral, constructivist, and social learning. Cognitive-behavioral interventions challenge irrational beliefs, teach relaxation and cognitive restructuring, and use graded exposure to mathematics; they reliably raise test performance and often reduce anxiety. Constructivist approaches emphasize hands-on, inquiry-oriented, and collaborative problem solving, remove counterproductive time pressures, and prioritize relational understanding over rote procedures. Social learning strategies leverage peer modeling, tutoring, and supportive classroom norms to build self-efficacy. In practice, effective programs integrate these strands into multimodal designs that combine emotion regulation, conceptual scaffolds, and structured peer support. The review also summarizes assessment and evaluation. Widely used measures such as the MARS, AMAS, and MAS-UK enable screening and monitoring. Mixed-methods evaluations—pre/post-tests, growth models, interviews, and reflective writing—link anxiety reductions to gains in mathematical performance. Case studies during COVID-19 further highlight the benefits of collaborative, hands-on learning and mindfulness-based components. Implications follow for classroom practice and policy: adopt process-focused instruction, normalize help-seeking, embed brief CBT micro-lessons, expand peer supports, and fund rigorous, scalable interventions. Noted limitations include small convenience samples and uneven demographic representation; future research should pursue longitudinal, diverse, and comparative trials with transparent implementation fidelity. Overall, converging evidence shows that theoretically grounded, multimodal interventions can meaningfully reduce math

anxiety while enhancing achievement when implemented with fidelity and evaluated systematically. Clear reporting standards and equitable sampling will strengthen generalizability and classroom translation worldwide adoption.

Keywords: *math anxiety; cognitive-behavioral therapy; constructivist learning; social learning; multimodal interventions; assessment scales; self-efficacy.*

1. INTRODUCTION:

Math anxiety affects students across all age groups and all cultures. Research conducted in many countries has found that a relatively large number of students have negative feelings associated with math and therefore become incapable of demonstrating their full intellectual capacity in math and related subjects. Specific strategies have been developed primarily through a cognitive-behavioral theoretical approach to help not-so-math-happy students become more comfortable and confident in learning math. They have been implemented in a variety of settings and at different times throughout a student's school years. The strategies have consistently been found to be effective. Other approaches that draw upon constructivist theory and social learning theory have produced strategies characterized by hands-on learning activities, collaborative group work, modeling, and coaching, to name a few. These approaches can also help students feel more comfortable and confident in math while at the same time improving their achievement. The strategies based on these three theories have been combined in varying degrees to form multimodal theory-based interventions. More detailed descriptions of the three underlying theories and their associated strategies are provided in the following sections. The strategies are presented in the context of some of the conditions that contribute to math anxiety and hamper student achievement. Methods used to assess the degree of anxiety and to evaluate the effectiveness of interventions are also discussed.

2. Understanding Math Anxiety:

Math anxiety is a debilitating emotional response to math-related situations. Research consistently reveals its detrimental impact on performance, underscoring the urgency for effective coping strategies and support. Consequently, an expanding body of literature aims to aid student management of this prevalent apprehension and enhance achievement within math classrooms. To the benefit of the student, teacher, and researcher, the discussion that follows compiles recent research on interventions developed from established educational theories. Systematic descriptions of the applied theoretical concepts provide a clear rationale for the selection of treatment strategies used to diminish math anxiety in the classroom.

(i) Definition and Prevalence:

Math anxiety has gained increasing attention from students, educators, and researchers worldwide. Distinct from test anxiety in other academic subjects, it is recognized as a discrete form of anxiety. According to Hembree (1990), it involves feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems during either formal assessment situations or ordinary classroom activities. Ashcraft and Ridley (2005) define it as "a feeling of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problems both in ordinary life and in mathematical courses in school". Von Aster and Shalev (2007) emphasize the limitation of memory by anxiety, noting, "The

anxiety involved in the achievement tests burden the working memory in a way that it becomes a restrictive factor in a person's possibilities for achievement", thus leading to difficulties in performing math-related tasks.

Several theories provide insights into math anxiety and inform intervention strategies to reduce it and enhance students' achievement in math. When researchers link intervention strategies to their theoretical foundations, the impact of the programs becomes more apparent. Three of the more frequently applied theories for working with math anxiety are cognitive-behavioral, constructivist, and social learning. Cognitive-behavioral theory proposes that individuals change by modifying cognitive processing and erroneous thinking, which leads to behavioral changes. Students with math anxiety often negatively evaluate their performance, and cognitive-behavioral interventions aim to rebuild their self-image and enhance confidence and motivation. Constructivist theory, articulated by Piaget, Bruner, and Vygotsky, holds that individuals build new knowledge through experience. Providing hands-on activities and a safe learning environment may help students with math anxiety because they learn that making mistakes is part of the learning process. Social learning theory, developed by Bandura, emphasizes learning through observation and modeling in a supportive environment; thus, partnering students with peers who excel in math can foster positive role modeling and support.

(ii) Theoretical Frameworks:

Several theories provide foundations for math-anxiety interventions. Teaching and nor-mative theories of the emotions can help teachers understand the bases of their students' fear, giving students tools for self-evaluation and self-explanation of the sensations producing fear. Avoidance learning may be addressed through an instruction requirement to complete assigned work. The theory of constructive learning guides the substitution of hands-on mastery activities for a mastery-learning treat-ment program. These combined approaches have reduced the level of math anxiety in a study of 259 secondary school students. Math anxiety is a complex phenomenon. Three major theories of anxiety, including cognitive-behavioral, constructivist, and social learning, have generated interventions designed to reduce students' math anxiety level and to improve achievement.

The term math anxiety describes feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic tasks. Numerous studies in widely differing fields suggest that math anxiety has detrimental effects on achievement. Identification and assessment of anxiety levels, coupled with targeted interventions, can ameliorate the negative repercussions of this common experience. Studies assessing the impact of differ-ent types of anxiety-reducing interventions consider both quantitative and qualitative research methods. The resulting data inform test-taking strategies and recommended instructional practices designed to help students manage math anxiety, improve achievement, and learn to enjoy mathematics.

(iii) Impact on Student Performance:

Math anxiety theory proposes that math anxiety limits working memory capacity, which in turn reduces math performance. This theory accounts for the inferior math performance of people with math anxiety, especially in high-pressure situations, such as exams. Its main prediction — that people with low working memory and high math anxiety perform worse than others — has been confirmed.

A related theory integrates the attention control theory and Processing Efficiency Theory (PET) to explain the impact of different types of math anxiety on math test performance. For individuals with high testing math anxiety, directing their attention away from irrelevant threats during an exam reduces the consumption of their limited working memory resources by the central executive (a component sensitive to worry). This mechanism also enables them to allocate attention effectively to math-related threats, thereby diminishing the interference caused by anxiety and enhancing test performance. Conversely, for those with high learning math anxiety, diminishing attention toward math during the learning phase lessens the depletion of working memory resources associated with the phonological loop (which is engaged during rehearsal). Consequently, these individuals can better concentrate on math-related information, improving their learning test outcomes.

3. Theoretical Approaches to Interventions:

A variety of theory-based intervention techniques have proved effective in lowering math anxiety. Drawing on cognitive-behavioral, constructivist, and social learning theories, these approaches embrace a range of strategies. Cognitive-behavioral interventions ameliorate students' disruptive feelings by teaching them to challenge their irrational attitudes about mathematics. Constructivist interventions apply hands-on instructional designs to engage students in carrying out mathematical tasks collaboratively. Social learning theory underlines the importance of peer support and modeling in both instructional and cocurricular settings. The three main theoretical perspectives seldom operate independently in practice. Some emotion-regulation packages incorporate hands-on instructional methods. Several hands-on instructional studies explored constructivist theory together with social cognitive perspectives. The combined influences of cognitive-behavioral and social cognitive theories have long been recognized. Social cognitive theory was once considered a cognitive-behavioral orientation; it remains a central tenet of multi-modal treatment.

(i) Cognitive-Behavioral Theory:

Cognitive-behavioral theory postulates that fear, anxiety, and avoidance are closely associated with specific thoughts, as well as the behaviors that accompany those thoughts. Based on this premise, individuals who experience a high level of anxiety in mathematics have evidently developed thoughts that mathematics is dangerous or indicative of personal failings. Numerous studies indicate that cognitive-behavior therapy is among the most widely applied intervention models for aggression and anxiety management, with substantial evidence supporting its effectiveness. Cognitive-behavioral theory also provides the foundational basis for addressing negative perceptions related to mathematics and for interventions focused on reducing anxiety levels. Complementary strategies derived from this framework include systematic desensitization, relaxation training, and graded task assignments. Additional intervention techniques incorporated within the cognitive-behavioral paradigm encompass cognitive therapy, social rehearsal, and explicit training in problem-solving skills.

(ii) Constructivist Theory:

Under the constructivist theory of learning individuals actively construct their own knowledge through experience and reflection. Learners build their own meaning by assimilating new experiences into existing cognitive structures and accommodating these structures to make sense of unfamiliar phenomena. This

educational theory focuses on how students learn or construct new knowledge rather than what they learn. Because of its attention to the individual construction of knowledge, a constructivist approach provides an ideal platform for intervening in the development of math anxiety a constructivist intervention has two strands. The first strand involves providing specific interventions at various stages of conceptual development either to move the learner's understanding forward or to provide support; the second strand helps the student understand the process of conceptual development itself. When employed properly, constructivist strategies can also help reinforce not only the content but also the process of construction for further learning in mathematics. Constructivist strategies embrace learning that is participatory, experimental, hands-on, inquiry-based, reflective, collaborative, and conceptual. Because the constructivist approach is based on personal sense making, it is idiosyncratic and individual and generally encourages collaboration and knowledge sharing as essential components of learning and research. Relational understanding takes precedence over instrumental understanding because the former provides the basis for constructing knowledge and the latter provides only a means of accessing knowledge. Dynamic assessment focuses on collaborative, mediated learning experiences, reciprocal dialogue, and bridges between a student's current knowledge and potential knowledge and can be used to encourage the development of mathematical literacy Constructivist interventions are especially effective when integrated with research-based instructional practices, such as inquiry labs: hands-on, collaborative, real-world applications.

(iii) Social Learning Theory:

Social learning theory argues that learners develop new behaviors by observing the behavior of a model. When others are capable of performing a particular task or behavior successfully, the likelihood that the observer will be encouraged to attempt the same task or behavior increases. For new behaviors, individuals infer the consequences of an action by observation. Social learning theory further proposes that the observation that others have had success gives the observer a measure of self-efficacy that they too can be successful. Social learning theory assumes that people learn new behaviors by observing others and imitating the modeled behavior. The type of model can be a teacher, peer, parent, significant other, or symbolic model such as television, Internet, or video games. Well-designed programs with supportive instructors and implemented in an environment where learner concerns about classroom conditions are acknowledged can foster affective support, a feeling of acceptance, and positive collaborative relationships can be created that may reduce math anxiety.

Considerable research demonstrates the link between social support and positive psychological and physiological outcomes in multiple constructs including general stress, anxiety, and well-being with students who have on-campus roommates reporting lower academic stress and better adjustment to college. The theory of social learning provides a framework for examining the impact of social support given the prescription of peer modeling as a component of an intervention and the strong operational definition of social support inherent in the models. Self-efficacy has been noted to be one of the primary components linked to the development of math anxiety and programs that target social support and modeling appear to be strongly associated with increased self-efficacy in multiple domains, including math.

4. Cognitive-Behavioral Interventions:

The theory of cognitive-behavioral intervention is to reduce anxiety by changing students' irrational thinking. Such interventions are effective for college students. An anxiety reduction intervention significantly improved college students' test performance. The one-hour session produced a substantial difference between the control and treatment groups' post-test scores. Although the anxiety score reduction was insufficient to reach statistical significance, the intervention powerfully inhibited further anxiety compared with controls. The intervention is based on the Yerkes-Dodson Performance Curve Model, which demonstrates that excessive pressure undermines optimal performance; internalizing this model fosters emancipation and empowerment, enabling students to manage rather than be overwhelmed by anxiety. Without relief, escalating anxiety leads to learned helplessness. The intervention facilitates a shift from a vicious to a successful cycle through refutation of irrational thoughts. A seven-statement survey acknowledges and validates students' math anxiety, a potent antidote to isolation and the vicious cycle of irrational thinking. Anxiety is not accepted as an excuse for poor performance; instead, students are offered strategies to assume responsibility and regain control. The ultimate aim is to promote self-efficacy and progress toward success.

(i) Techniques and Strategies:

Various techniques are commonly deployed in classrooms to mitigate math anxiety, with efficacy often contingent on implementation fidelity. These methods are typically framed within cognitive-behavioral, constructivist, and social learning theories. A commonly employed strategy involves exposing students to a broad spectrum of mathematical topics, emphasizing effort and growth rather than innate ability, thereby promoting problem-solving and organizational skills and reducing fear associated with specific tasks. Teachers who endorse the constructivist view of mathematics—perceiving it as a dynamic field open to interpretation—frequently implement hands-on and collaborative activities that foster deeper conceptual understanding. Additionally, social learning interventions utilize peer support and modeling to alleviate anxiety, encouraging students to share difficulties and observe effective behavioral strategies. More comprehensive, multi-modal interventions integrate elements from these three theoretical frameworks, commonly employing diagnostic assessments to identify anxiety levels and inform the application of targeted strategies.

(ii) Effectiveness and Outcomes:

Fundamental indicators of the effectiveness of an intervention include improvements in students' mathematical performance and reductions in experienced math anxiety. Research assessing theory-based interventions typically investigates their impacts on both of these factors, guided by the premise that alleviating anxiety can enhance academic results. A study implementing a concise, one-hour cognitive-behavioural session demonstrated a significant increase in post-test scores for students in developmental mathematics courses, although the accompanying drop in anxiety levels did not reach statistical significance; the findings nonetheless confirmed anxiety's role as a powerful inhibitor of performance. The data conformed closely to the ''performance curve'' model, which characterizes how excessive pressure undermines ability. Interventions structured around this theoretical framework therefore emphasise the importance of helping students acknowledge and validate their anxiety, replace irrational self-statements with rational alternatives,

and develop a sense of agency in the regulation of their emotional response. This approach proved successful in shifting participants' attitudes from the ''vicious cycle'' of fearfulness and maladaptive coping towards a ''success cycle'' of greater confidence and improved outcomes.

Measures of anxiety and performance have also been employed to evaluate the relative efficacy of theory-based instructional models. A recent comparison of theory-grounded interventions concluded that those emphasising hands-on activities and cooperative learning are especially effective in reducing students' anxiety and elevating their achievement; these results accord with earlier evidence that 'manipulative--often physical materials that afford tactile experiences--can assist students in lowering math anxiety', while collaborative structures provide opportunities for peer support and the demonstration of positive behavioural norms. There are reasons to believe, furthermore, that combining elements from different theoretical frameworks can produce powerful, integrated multi-modal interventions, a possibility illustrated by the International Study on Mathematics and Science Teaching. This large-scale programme draws simultaneously on social learning, constructivist, and cognitive-behavioural perspectives; it synthesises small-group approaches, hands-on activities, cooperative exercises, and anxiety-related techniques in a coherent system defined by the principles of 'inquiry learning' and 'active participation'. Ongoing implementation highlights the viability of such hybrid approaches as a means of addressing the diverse needs of contemporary students.

5. Constructivist Approaches:

Hands-on and collaborative-learning approaches—hallmark features of student-centered constructivist theory—provide necessary support for vulnerable students and offer varied entry points to mathematics that favorably affect the level of math anxiety and a student's overall achievement. Implementing these methods is believed to prevent math anxiety effectively by catering to individual learning needs and promoting comprehension over memorization. Research endorses the removal of time constraints from assessments, as timed tests frequently serve as significant triggers of math anxiety. Adopting a problem-solving approach with multiple entry points further alleviates anxiety by accommodating diverse thinking styles and competencies. Although such individualized problem design demands additional time and effort from educators, it remains the most proactive strategy against math anxiety currently recognized. Brain-based learning amplifies these benefits by addressing the emotional dimensions of learning; incorporating manipulatives for elementary students, for instance, both mitigates anxiety and enhances performance. Collectively, these constructivist strategies underscore the essential role of process-focused, relevant applications in diminishing math anxiety and bolstering achievement.

(i) Hands-On Learning Activities:

Math educators have devised numerous methods to reduce student anxiety related to the subject, ranging from informal practices to formal theory-based interventions classified as psychotherapeutic, cognitive-behavioral, constructivist, and social learning. The section 'Cognitive-Behavioral Theory-Based Interventions' examines strategies aimed at altering negative career perceptions that contribute to math anxiety. It then discusses how constructivist theory justifies hands-on activities that provide structural contextualization and collaborative benefits for anxiolytic effects. Subsequently, the social learning theory

underpinnings of peer networking as a preventive tool are outlined. Combined approaches integrating features from these major theories feature in the section 'Multi-Modal Theory-Based Interventions.' The final part, 'Anxiety Assessment and Evaluation,' addresses diagnostic tools and methodologies for assessing the efficacy of such interventions.

The methodological differences in addressing math anxiety can be understood through the application of diverse psychological theories. For example, psychotherapeutic measures often adopt a cognitive-behavioral approach based on altering thinking patterns connected with mathematics careers. Alternatively, involving students in hands-on activities aligns with constructivist theory, which provides explanations for why such approaches are more effective than traditional teacher-centered methods. Social learning theory supports the hypothesis that student peer networking can prevent the development of debilitating levels of anxiety. Each theory is associated with one or more models demonstrating how actions derived from these perspectives improve math achievement and reduce math anxiety, often through structured and contextualized activities. In particular, hands-on learning serves as a practical illustration of the constructivist orientation.

(ii) Collaborative Learning Environments:

Collaborative, hands-on learning opportunities provide affective benefits for students. Student collaboration appears to reduce math anxiety while also enhancing mathematics achievement. The use of cooperative mathematics, defined as working together to accomplish a shared goal toward mathematical concepts, has been identified as an effective strategy to alleviate math anxiety. Theorists therefore advocate that math anxiety interventions incorporate cooperative and peer mathematics activities or group work into their programs.

6. Social Learning Interventions:

Social learning theory highlights the vital role of social interactions in fostering changes in cognitive, affective, and behavioral patterns. Peer-mediated interventions offer one avenue for alleviating mathematics anxiety in inclusive settings. This stable affiliation aimed to foster ongoing engagement and facilitate behavioral change through positive social interaction. Peer and peer-instructor modeling emerges as another effective approach attributing to reductions in mathematics anxiety. Observing models who perform mathematics confidently and express positive attitudes can help learners restructure their own competencies and emotions, thereby diminishing negative responses. Both modeled coping strategies and the relational dynamics inherent in peer modeling serve as mechanisms for alleviating stress and anxiety within mathematical tasks.

A number of social support models focus on the quality of peer relations to encourage students to talk freely about their anxiety and lessons. Peers and role models provide additional sources of support and contribute to engagement and achievement, especially when the resource is a near peer, preferably a friend to the learner. Semi-structured peer tutoring focuses on having peer pairs create problems and strategies to review both content and problem processes. Success of paired interventions is linked to broad benefits for learning and motivation as well as social and behavioral development. Applying design-based research principles is crucial to improving the effectiveness of such interventions, especially in digital environments like social

media. The pedagogical mechanism of learning-by-teaching through peer tutoring enhances motivation and self-regulated learning, contributing positively to mathematics achievement.

Math anxiety impacts scholastic achievement by interfering with cognition, attention, and motivation. Theories provide robust frameworks for interventions. Cognitive-behavioral theory, for instance, targets intrusive thoughts and remedial behaviors. Constructivist theory motivates learner-centered interventions that promote interaction with concepts and others. Social learning theory highlights peer support and modeling.

Modeling is integral to social learning theory, providing a process by which individuals learn external behaviors as well as internal cognitive and affective processes. For example, models can influence self-efficacy and even determine what is modeled, omitting prescribed behaviors and focusing on self-regulated ones. In the educational context, modeling is an effective form of education supported by several theoretical frameworks, and is pervasive in everyday experience. Models are of three general kinds: live models, symbolic models, and verbal models. Live modeling provides tangible evidence of behavior while offering a sense of predictability for future situations that may require the behavior. Symbolic models convey an amalgamation of information that cannot be simultaneously performed and dependent on the observer for construction. These models require guided construction to be useful. Verbal models instruct the observer on how to proceed and are the most common presentation mode in formal education. All three modes are prevalent in the math anxiety intervention literature.

7. Assessment of Math Anxiety:

Tools to assess for math anxiety can help educators determine the level of math anxiety their students may be facing. Identification can then enable more direct intervention. In fact, math anxiety need not be confined to the classroom, as experiencing even mild levels of math anxiety results in the tendency to avoid math-related content in one's everyday life. Therefore, persistent and highly-avoidable math anxiety can have long-lasting consequences.

Some effective examples of math anxiety scales are the Abbreviated Math Anxiety Scale (AMAS) and the Math Anxiety Scale–UK (MAS-UK), which are based on the more-expansive Mathematics Anxiety Rating Scale (MARS). Using the Rasch rating scale model, was able to create an 8-item short form.5 found a considerable overlap in terms of scoring between the AMAS and MAS-UK, as well as support for a high level of validity and reliability for both scales. In addition, Ishido was able to create a short scale for the assessment of math anxiety, the Harm Concept Anxiety Scale, which is based on the concept of mathematics anxiety.

Math anxiety is commonly defined as a feeling of tension or apprehension that interferes with math performance, or as an emotion of fear or apprehension specifically associated with math situations. Given the high prevalence of math anxiety and its disruptive interference with math performance, practitioners and researchers have developed a variety of research instruments and clinical techniques to measure and address this construct. Such methods include Likert-scale questionnaires, interviews, numerical rating scales, and weekly written reflections. Recent research also proposes multisystem interventions to reduce math anxiety, bringing together methods from diverse fields such as neuroscience, social psychology, racial stereotype

threat, and cognitive–behavioral therapy. A thorough examination of these tools is essential for practitioners and researchers aiming to design effective, targeted interventions suitable for the current educational context.

Numerous instruments have been developed to identify and quantify mathematical anxiety in both children and adults. These can be broadly classified as explicit or implicit measures, depending on whether respondents directly report on their attitudes and feelings about mathematics or provide indirect information. Recent literature presents a detailed definition of these methodologies, highlighting the contributions of relevant studies. Math anxiety may also be assessed through diagnostic interviews, behavioral assessments of math avoidance, or physiological indicators such as heart rate and pupil dilation. A recent meta-analysis lends support to several theoretical models of math anxiety by establishing valid and reliable diagnostic tools.

Understanding and measuring math anxiety are important for developing tailored interventions. Investigators have explored the nature and scope of the anxiety by employing various assessment tools and methods. In the early 1950s, specific tests were published to measure the construct, such as the math anxiety rating scale (MARS) by Richardson and Suinn (1972). Other diagnostic approaches include the use of focus groups, personal analysis and reflection, and interviews.

8. Implications for Educators:

Math anxiety influences future choices, increasing the likelihood of avoiding math-related careers; the opposite relationship holds for math interest. Education and teachers have high impact in the development, suppression, or reduction of math anxiety. Klips surveyed math frustration, distress, and anxiety, focusing on why some students experience math anxiety, whether anxiety affects achievement, and the relationship to teachers and schools. Negative experiences can lead to "math trauma," creating an aversion that blocks learning. Research supports the need for interventions that attack the causes.

(i) Best Practices in Teaching:

Many state standards documents provide guidelines related to teaching approaches and learning expectations; however, they do not identify best practices. Perceptions regarding the teaching of mathematics and the methods commonly used in schools lead to high levels of anxiety among middle and secondary school students and even among college students. Therefore, a review of interventions based on relevant theories is necessary to identify worthy classroom practices that reduce mathematics anxiety and lead to enhanced achievement. Two large-scale surveys administered to secondary and postsecondary students illustrate the scope of mathematics anxiety as it relates to mathematics education.

Approximately 91% of all participants in the report K-12 teachers' beliefs about iPads and other tablet devices indicated that lecture was the main instructional technique used in high school mathematics classes. Teachers who rely heavily on lecture tend to focus on the memorization of content and rules rather than understanding the concepts or seeing their potential real-life application. Students who are presented with instruction primarily focused on memorization are unable to establish conceptual connections across mathematical topics, and long-term retention of content is limited.

Constructivism, a teaching approach based on the work of Piaget and Bruner, emphasizes hands-on experiences and learning activities that focus on a particular environment; student progress reflects an

understanding of the conceptual connections between mathematical ideas. Numerous studies over the past 30 years have indicated that knowledge gained via constructivist methods results in improved retention and superior performance on conceptually based problems. Students also need to overcome negative self-talk when confronted with mathematics assessments. When concepts are unclear and the solutions difficult to interpret, students who continue answering problems without asking for assistance tend to increase their anxiety. The ability to identify which questions to ask is an important skill students need to develop; therefore, a classroom system that enables students to ask questions while maintaining their pride should be established. Teachers can have students indicate when they need assistance by using a discreet signal, such as raising a finger. With a system in place, students are more likely to ask questions and obtain clarification instead of "playing dumb" or guessing at a solution.

9. Creating Supportive Learning Environments:

In order to make the learning environment supportive, it is crucial to understand the factors that influence student adjustment, motivation, and achievement. Support received from teachers—in the form of emotional, informational, and instrumental support—plays a vital role. Teacher support can moderate students' math self-concept, mathematics anxiety, and achievement. The development of self-regulation during adolescence strongly depends on whether teachers exhibit supportive rather than undermining behaviours. Relationships between children and their teachers impact the students' perceptions of their own competence and their engagement in learning. Peers and their influence become a more valued reference point with respect to valuing mathematics, motivation, and achievement. Hence, the interplay between students and teachers is critical for academic enablers and engagement. Additional evidence from large-scale data-sets indicates that perceived teacher affective support significantly influences the motivation of middle-school students in mathematics.

Furthermore, students' perceptions of self-efficacy and their motivation are linked to their expectations and learning strategies. Cognitive supports, such as analogies, can facilitate learning in mathematics. Mathematics anxiety has been shown to associate with working memory, and this pattern corroborates earlier findings that mathematics anxiety influences early mathematics achievement.

10.Limitations of Current Research:

Research on interventions to reduce math anxiety is predominantly based on small, non-random, convenience samples with inherent limitations on external validity. Diverse student needs and demographic groups often remain underrepresented, impeding conclusions about variation in intervention efficacy by gender or race/ethnicity.

These constraints pose challenges to generalising findings to broader populations. Additional research is required across multiple school settings and teaching configurations, given the significant influence of instructional methods on math anxiety. Expanding study samples would enable identification of the most effective interventions and delivery formats for distinct groups. Complex factors such as the COVID-19 pandemic, home-schooling dynamics, and disparate access to remedial support are widely recognised

contributors to heightened anxiety and academic disruption in areas including mathematics. Understanding student support needs is critical to promoting academic success and healthy social development.

Targeted assistance may facilitate re-engagement in academic and social activities for many pupils as they return to traditional education. Without tailored interventions, continued difficulty in academic reorientation and feelings of isolation may increase the risk of school withdrawal, perpetuating associated adverse social and psychological effects.

(i) Challenges in Generalization:

The complexity of transferring positive outcomes from one educational setting to another often limits the practical application of intervention programs. Both quantitative and qualitative studies, predominantly with elementary populations, struggle to generalize findings beyond their immediate context. Large-scale research initiatives tend to oversample at-risk elementary students, which raises additional questions about the applicability of theory-based interventions across diverse populations. Given the global recognition of math anxiety among various age groups and cultures, broadening the scope of investigation to encompass unaffected and differently affected populations is imperative. Discerning the nuances of who is impacted by math anxiety will inform the development of targeted strategies aimed at building resilience through theory-based approaches.

(ii) Need for Diverse Populations:

The majority of current research on theory-based interventions either precludes or does not explicitly test hypotheses regarding broad demographic factors. Most existing studies instead utilize remaining demographic factors, such as gender and ethnicity, as covariates only or confine their investigation to extremely narrow populations. Consequently, the relevance of extant findings for academic concerns, such as underperformance or persistence in scientific disciplines, remains a question. To address this, recent research has begun to employ descriptive and inferential statistics to examine differences in attitudes toward science and how socioemotional variables may mediate these relationships. These analyses seek to clarify alignment between variables and to identify the necessity for further, more informative investigation.

11.Conclusion:

Math anxiety is characterized by tension, apprehension, or fear of mathematics that interferes with computation, problem solving and the students' everyday life. Math anxiety is a prevalent problem in many students and individuals. Improving student achievement by addressing the roots of math anxiety is a beneficial undertaking. Theory-based approaches can contribute in further advancing treatment plans of effective math-anxiety interventions. Understanding these theoretical approaches is important because many practical methods and techniques are derived from a given theory. Frameworks underlying current methods and experimental interventions demonstrate potential means to begin the process of dispensing effective interventions.

While the specific nature of application may differ among approaches, common to all is the role of personal experience in influencing performance. Identification and assessment are critical to successful use of any theoretical approach. Formal assessment can identify the degree of severity, and can assist in selecting an

orientation most appropriate to the particular individual or group. Since interventions derived from various perspectives continue to evolve, evaluation of treatment outcomes is essential so that the most current and effective approaches are readily identifiable. Intended as a supplement to traditional classroom instruction, theory-based intervention begins to offer a comprehensive, flexible means to improve performance and increase achievement. Along with any understanding of mathematical anxiety, the importance of the teaching process constantly develops. Many important theories combine constructive apprenticeships, allowing an ideal balance for education in mathematics. Mathematical anxiety is an issue that has impeded many from understanding the subject. Theory-based intervention and treatment may lead to a solution that provides a profound understanding of mathematics that many adolescents require and desire.

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