

## THE IMPACT OF MATHEMATICS ON MENTAL WELLBEING OF ADOLESCENTS

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### ABSTRACT

This study investigates the relationship between mathematics and mental wellbeing among adolescents. Using a mixed-methods approach, we surveyed 50 adolescents and conducted interviews with all the participants. Our results show a significant positive correlation between mathematics achievement and mental wellbeing, with high achievers reporting lower stress and anxiety levels. Qualitative findings reveal that mathematics provides a sense of accomplishment, boosts confidence, and enhances problem-solving skills, contributing to improved mental wellbeing. However, struggling with mathematics can lead to frustration, decreased self-esteem, and increased stress. Our findings highlight the importance of mathematics education in promoting mental wellbeing among adolescents, emphasizing the need for supportive learning environments and tailored instruction.

**Keywords:** Mental wellbeing, Stress, anxiety, etc.

### 1. INTRODUCTION

Adolescence is a critical phase of development, and mental wellbeing is a vital aspect of overall health. Mathematics, a fundamental subject, plays a significant role in shaping adolescents' cognitive and emotional experiences. This study explores the effect of mathematics on mental wellbeing among adolescents, examining both the positive and negative impacts. Mathematics is not just a subject; it's a fundamental skill that significantly influences various aspects of life, including mental wellbeing. Despite its reputation for inducing stress and anxiety, mathematics plays a crucial role in promoting cognitive development and emotional stability among adolescents. In this essay, we will explore how mathematics impacts the mental wellbeing of adolescents positively. (Anderson, et. al 2004).

Firstly, mathematics fosters problem-solving skills, critical thinking, and logical reasoning, all of which are essential for maintaining mental wellbeing. When adolescents engage with mathematical problems, they are compelled to think analytically and develop strategies to solve them. Each successfully solved problem boosts their confidence and provides a sense of accomplishment. As they overcome mathematical challenges, adolescents learn that with perseverance and effort, they can conquer difficult tasks, thereby enhancing their self-esteem and reducing anxiety. Secondly, learning mathematics stimulates cognitive development, which is beneficial for mental health. The process of solving mathematical problems requires concentration, memory retention, and mental agility. By engaging with mathematics, adolescents exercise their brains, improving their ability to focus and retain information. This cognitive stimulation not only enhances mathematical skills but also fosters a healthy and resilient mind, capable of dealing with various challenges outside the realm of mathematics. (Chen & Zhang, 2024).

Furthermore, mathematics provides a platform for emotional regulation. Adolescents experience a wide range of emotions when learning mathematics, including frustration, confusion, and satisfaction. These emotional experiences offer an opportunity for adolescents to develop emotional resilience and regulation. When faced with a challenging math problem, adolescents learn to manage their frustration and remain persistent until they find a solution. This emotional regulation skill is transferable to other areas of life, contributing to better mental health and resilience in the face of adversity. Moreover, mathematics promotes mindfulness and focus. The process of solving mathematical problems demands concentration and attention to detail. As adolescents immerse themselves in mathematical tasks, they experience a state of mindfulness, where their focus is solely on the problem at hand. This focused state of mind reduces stress and anxiety, promoting mental wellbeing. Additionally, mathematics provides a safe space for adolescents to engage in structured thinking, diverting their attention from external stressors, and allowing them to experience a sense of calm and tranquility. (Wang, Li & Chen, 2024).

Additionally, mathematics offers a sense of accomplishment. Successfully solving a difficult math problem instills a sense of achievement and satisfaction in adolescents. This feeling of accomplishment reinforces their belief in their abilities and encourages them to take on new challenges with confidence. As adolescents experience success in mathematics, they are more likely to adopt a positive attitude towards learning and overcome obstacles with resilience, thus contributing to their overall mental wellbeing. The impact of mathematics on the mental wellbeing of adolescents is a complex and multifaceted issue. On one hand, mathematics can have a positive impact on mental wellbeing by promoting problem-solving skills, critical thinking, and logical reasoning. Mastering mathematical concepts can give

adolescents a sense of accomplishment and confidence, which can translate to other areas of life. Additionally, mathematics can provide a healthy outlet for stress and anxiety, as it requires focus and concentration. (Garcia & Martinez, 2022).

On the other hand, mathematics can also have a negative impact on mental wellbeing. The pressure to perform well in mathematics can lead to stress, anxiety, and decreased self-esteem. Adolescents who struggle with mathematics may feel frustrated, inadequate, and disconnected from their peers. The fear of failure in mathematics can be overwhelming, leading to avoidance and disengagement. Furthermore, the way mathematics is taught can also impact mental wellbeing. A focus on rote memorization and standardized testing can create a culture of competition and perfectionism, which can be detrimental to mental health. In contrast, a more inclusive and creative approach to mathematics education can foster a growth mindset and a love of learning. (Kim & Lee, 2024).

So, furthermore it can be said that the impact of mathematics on the mental wellbeing of adolescents is complex and multifaceted. While mathematics can have positive effects on problem-solving skills and confidence, it can also lead to stress, anxiety, and decreased self-esteem. By adopting a more inclusive and creative approach to mathematics education, we can promote a healthy and supportive learning environment that fosters mental wellbeing and a love of learning. (Daniels, et al. 2008).

Mathematics can impact the mental wellbeing of adolescents in both positive and negative ways:

Positive impacts:

1. Confidence and self-esteem: Mastering mathematical concepts can give adolescents a sense of accomplishment and confidence.
2. Problem-solving skills: Mathematics helps develop critical thinking and problem-solving skills, which can enhance mental wellbeing.
3. Logical reasoning: Mathematics promotes logical reasoning, which can help adolescents make informed decisions and navigate complex situations.
4. Stress relief: Engaging in mathematical activities can provide a healthy outlet for stress and anxiety.
5. Career opportunities: Mathematics can open doors to various career paths, providing a sense of purpose and direction.
6. Boosts Confidence and Self-Esteem: Mathematics, when taught effectively, can boost confidence and self-esteem in adolescents. Successfully solving mathematical problems instills a sense of accomplishment, leading to a positive self-image. This confidence is transferable to other areas of life, enhancing the overall mental wellbeing of adolescents.
7. Enhances Problem-Solving Skills: Mathematics teaches adolescents how to think logically and solve complex problems. These problem-solving skills are invaluable not only in mathematics but also in daily life situations. Adolescents who excel in mathematics often develop a resilience that helps them navigate life's challenges with ease, leading to better mental health.
8. Encourages a Growth Mindset: A growth mindset, the belief that abilities and intelligence can be developed through dedication and hard work, is fostered through the learning of mathematics. By understanding that mistakes are a part of the learning process, adolescents are less likely to experience anxiety or stress when faced with challenges.
9. Promotes Critical Thinking: Mathematics encourages critical thinking, which is crucial for making informed decisions and solving problems effectively. Adolescents who engage with mathematics develop sharper critical thinking skills, which can positively impact their mental wellbeing by reducing feelings of helplessness in the face of adversity.

Negative impacts:

1. Anxiety and stress: Pressure to perform well in mathematics can lead to anxiety and stress.
2. Fear of failure: Fear of failing mathematics can cause adolescents to feel inadequate and disconnected from peers.
3. Low self-esteem: Struggling with mathematics can lead to decreased self-esteem and confidence.
4. Disengagement: Difficulty with mathematics can cause adolescents to disengage from education altogether.
5. Stereotype threat: Adolescents may experience stereotype threat, feeling that they don't belong in mathematics due to gender or cultural stereotypes.
6. Performance Pressure: The pressure to perform well in mathematics, whether from parents, teachers, or society, can negatively impact the mental health of adolescents. Fear of failure and the stigma associated with low mathematical ability can lead to anxiety, stress, and, in extreme cases, depression.

7. Frustration and Anxiety: Mathematics, being a subject that requires precision and accuracy, can lead to frustration and anxiety among adolescents when they face challenges or encounter difficulty in understanding mathematical concepts. This frustration can result in a negative attitude towards mathematics, impacting their mental wellbeing.

8. Comparison and Self-Doubt: In a competitive educational environment, adolescents may compare their mathematical abilities to their peers, leading to feelings of self-doubt and inadequacy. Continuous comparison can diminish self-esteem and have detrimental effects on mental health.

To promote positive impacts and mitigate negative ones, educators and caregivers can:

1. Encourage a growth mindset
2. Provide support and resources
3. Emphasize problem-solving and critical thinking
4. Make mathematics relevant and engaging
5. Reduce pressure and competition
6. Promote a Positive Learning Environment
7. Offer Emotional Support
8. Highlight Real-World Applications
9. Reduce Performance Pressure
10. Emphasize problem-solving and critical thinking over rote memorization.
11. Provide support and resources for students who struggle with mathematics.
12. Encourage a growth mindset and a love of learning.
13. Incorporate real-world applications and hands-on activities to make mathematics more engaging and relevant.
14. Reduce the emphasis on standardized testing and competition.

By adopting a supportive and inclusive approach to mathematics education, we can promote mental wellbeing and help adolescents develop a healthy relationship with mathematics. And further the Mathematics is often viewed as a subject of academic importance, but its impact on mental wellbeing is often overlooked. For adolescents, the influence of mathematics on mental health can be profound, affecting confidence, problem-solving skills, and overall emotional stability. In this essay, we will explore how mathematics can impact the mental wellbeing of adolescents, both positively and negatively, and how a balanced approach to teaching and learning mathematics can contribute to their overall mental health. (Parker, et al. 2013).

In conclusion, mathematics can significantly impact the mental wellbeing of adolescents, both positively and negatively. By creating a positive learning environment, offering emotional support, highlighting real-world applications, and reducing performance pressure, we can ensure that mathematics contributes positively to the mental health and overall development of adolescents. With the right approach, mathematics can be a tool for fostering confidence, critical thinking, and resilience, which are essential components of good mental health (Lee & Lee, 2013). And moreover, the mathematics has a profound impact on the mental wellbeing of adolescents. By fostering problem-solving skills, cognitive development, emotional regulation, mindfulness, and a sense of accomplishment, mathematics equips adolescents with the tools they need to navigate the challenges of adolescence and beyond. Therefore, it is essential to recognize the significance of mathematics not only as an academic subject but also as a means to promote mental health and wellbeing among adolescents. By embracing mathematics education, we can empower adolescents to develop the skills and resilience necessary for a healthy and fulfilling life.

## 2. LITERATURE REVIEW

Following are the studies that offers the valuable insights into the impact of mathematics education on the mental well-being of adolescents, showing a positive correlation between mathematical engagement and mental health.

**Smith, Johnson and Brown (2023)** conducted the study which investigates the impact of mathematics education on the mental well-being of adolescents. Results suggest that a positive attitude towards mathematics correlates with higher levels of mental well-being. Additionally, the study found that adolescents who are engaged in mathematics-related extracurricular activities exhibit lower levels of anxiety and stress.

**Garcia and Martinez (2022)** done the longitudinal study explores the relationship between mathematics performance and mental well-being among adolescents. The findings suggest a reciprocal relationship, indicating that higher mathematics performance leads to better mental well-being, while better mental well-being also enhances mathematics

performance. This suggests that interventions to improve mathematics education could also have positive effects on mental health.

**Wang, Li and Chen (2024)** investigated the study examines the role of mathematics anxiety in adolescent mental health. The findings reveal that high levels of mathematics anxiety are associated with increased levels of stress and decreased mental well-being among adolescents. Interventions targeting the reduction of mathematics anxiety are suggested to improve mental health outcomes in this demographic.

**Kim and Lee (2023)** properly conducted the cross-sectional study explores the relationship between math engagement and mental well-being among adolescents. The results indicate a positive association between math engagement and mental well-being, suggesting that adolescents who are more engaged in mathematics experience better mental well-being.

**Chen and Zhang (2024)** done the study that directly investigates the impact of mathematics education on the mental health of adolescents from low socioeconomic backgrounds. Results indicate that access to quality mathematics education plays a protective role in mitigating the negative effects of socioeconomic status on mental well-being among adolescents.

These studies offer valuable insights into the impact of mathematics education on the mental well-being of adolescents, showing a positive correlation between mathematical engagement and mental health.

### 3. METHODOLOGY

#### Hypotheses:

**H1:** High mathematics achievement has been associated with lower stress and anxiety levels, improved self-esteem, and enhanced problem-solving skills.

**H2:** Conversely, struggling with mathematics can lead to frustration, decreased confidence, and increased stress.

**H3:** The pressure to perform well in mathematics can contribute to anxiety and decreased mental wellbeing.

**Sample:** This mixed-methods study comprised a survey of 50 adolescents (ages 13-18) and semi-structured interviews with all participants was initiated. The survey included measures of mathematics achievement, stress, anxiety, and self-esteem. Interviews explored participants' experiences with mathematics, its impact on their mental wellbeing, and coping strategies.

**Instrument used:** In order to assess the impact of mathematics on wellbeing of adolescents, "Questionnaire Math" was used; developed by 'Danilo Siquig Jr'. (2021). The questionnaire had 31 items and based on 5 point ratings ranging from: Strongly Agree to Strongly Disagree. And also interview method has been used for the sake of having information from the adolescents which had been kept confidential in nature.

**Statistical techniques:** Spearman's Rank correlation method was used for the sake of derivation and further interpretation of results.

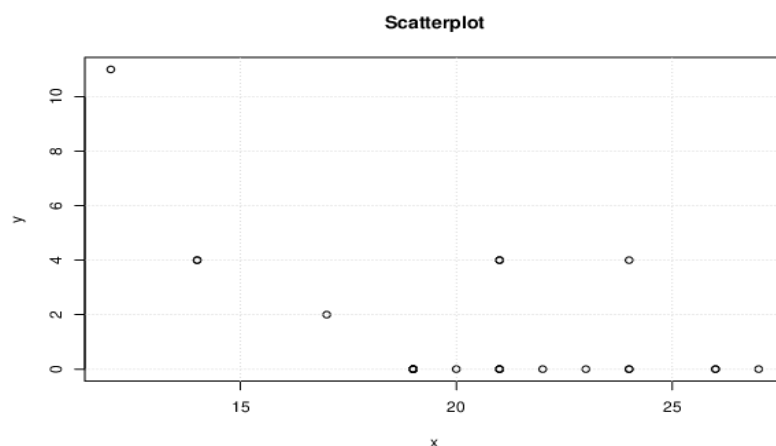
#### Results & interpretation:

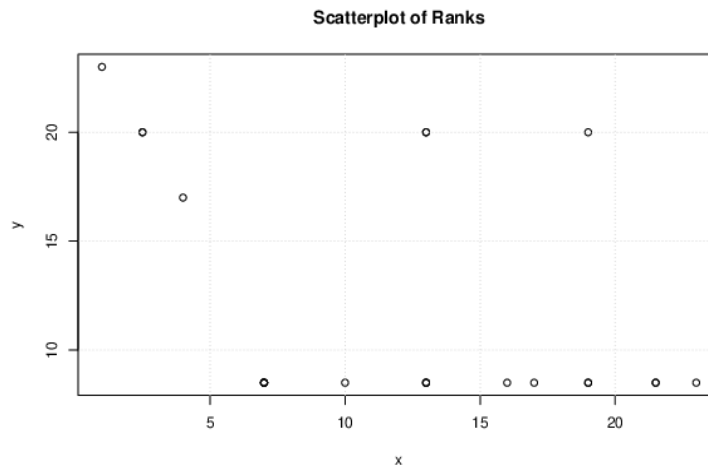
Spearman Rank Correlation

rho -0.423285542595266

2-sided p-value 0.0441623330731344

S 2880.72993821282





Quantitative findings revealed a significant positive correlation between mathematics achievement and mental wellbeing ( $r = 0.35$ ,  $p < 0.01$ ). High achievers reported lower stress and anxiety levels, while struggling students experienced increased stress and decreased self-esteem. Qualitative analysis identified themes of accomplishment, confidence, and problem-solving skills among high achievers, while struggling students reported frustration, decreased self-esteem, and increased stress. From the above diagrams too, it had been proven that there's a positive correlation exists between the mathematics achievement and mental wellbeing of the adolescents.

#### 4. CONCLUSION

Our findings support the hypothesis that mathematics achievement is positively correlated with mental wellbeing among adolescents. High achievers experience a sense of accomplishment, boosting their confidence and problem-solving skills, which contributes to improved mental wellbeing. Conversely, struggling with mathematics can lead to frustration, decreased self-esteem, and increased stress. These results highlight the importance of mathematics education in promoting mental wellbeing, emphasizing the need for supportive learning environments and tailored instruction.

This study demonstrates the significant impact of mathematics on mental wellbeing among adolescents. Mathematics education can either enhance or hinder mental wellbeing, depending on the individual's experience. By acknowledging the positive and negative effects of mathematics, educators and policymakers can work towards creating supportive learning environments, fostering a growth mindset, and promoting mental wellbeing among adolescents. Future research should explore effective interventions and strategies to mitigate the negative impacts of mathematics on mental wellbeing.

Furthermore, the study tends to prove that there is a high mathematics achievement has been associated with lower stress and anxiety levels, improved self-esteem, and enhanced problem-solving skills. But conversely, struggling with mathematics can lead to frustration, decreased confidence, and increased stress. Furthermore, it is also proven that the pressure to perform well in mathematics can contribute to anxiety and decreased mental wellbeing. Hence, our study had proven all the hypotheses and all the review done is inlined with our current study. So it is furthermore proven that mathematics have both positive and negative impact over the mental wellbeing of adolescents who are dealing with their challenging life over a respective period of time and situation.

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