Correlation between Mindfulness Level and Cognitive Efficiency among Higher Secondary Students

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ABSTRACT

The goal of the study was to investigate the connection between higher secondary students cognitive efficiency and mindfulness. The capacity to sustain present moment awareness with openness and nonjudgmental is known as mindfulness and it has been associated with improve executive functioning working memory and attention. Academic success depends on cognitive efficiency which includes attentions control information processing speed and problem solving skills. In this study stratified random selection was used to choose a sample of 200 students (100 boys and 100 girls) from government and private schools in Tamil Nadu for the correlation research design. The Mindful Attention Awareness Scale (MAAS) was used to examine mindfulness and a standardized cognitive efficiency inventory was used to test cognitive efficiency. Descriptive statistics, Pearson's correlation and independent sample t-test were used in the data analysis. Higher levels of mindfulness are linked to improve cognitive functioning according to the study finding which showed a strong positive connection between mindfulness and cognitive efficiency. While there was no discernible gender difference in cognitive efficiency gender analysis revealed that girls scored significantly higher those boys in mindfulness. These results highlight how importance it is to include mindfulness based activities in school curricula and teacher preparation programs. It is advised that future studies use experimental or longitudinal designs to determine causal links and look at long term higher level of mindfulness are linked to improve cognitive functioning.

Keywords: Mindfulness, Cognitive efficiency, Higher Secondary Students, Attention, Working Memory

INTRODUCTION

A statement by Steinberg (2017), one of the most revolutionary phases of human development adolescence is marked by quick social, emotional and cognitive development. People start to build their identities become independent and acquire higher order cognitive skills at this time. These development shifts correspond with increased academic obligations competitive exams and social obstacles for higher secondary students, who are usually between the ages of 16 and 18. Stress anxiety and emotional disorders are frequently brought on by the pressure to perform well academically which can have a detrimental effect on focus judgment and learning effectiveness (Bhasin & Sharma, 2020). In this regard developing mindfulness has become a useful tactic to improve teenagers' psychological health and cognitive abilities.

Kabat Zinn (1994) defined mindfulness as the deliberate non-judgmental practices of paying attention to the present moment. It entails self awareness acceptance and deliberate control over one's feeling and thoughts. From its traditional Buddhist origins mindfulness has developed over the past 20 years into a well recognized secular psychological concept that is used in the fields of business education and health (Baer, 2019). Improved attention regulation emotional equilibrium and meta-cognitive awareness, all essential elements of learning are linked to mindfulness in educational psychology (Roeser at. Al., 2013; Schonert Reichl & Lawlor, 2010).

Conversely cognitive efficiency is the capacity to make economical and effective use of cognitive resources including working memory reasoning and attention (Diamond, 2013). It includes people's ability to

comprehend information quickly and properly while reducing mental strain. More attention adaptability and problem solving skills are displayed by students with increased cognitive efficiency (Best & Miller, 2010). According to the research mindfulness based techniques can improve sustained attention and lessen mind wandering which can improve various elements of cognition (Zeidan et,al., 2020). This perspectives is further supported by the attention control hypothesis put forth by Eysenck et,al. (2007) which suggests that mindfulness improves attention deployment and reduce anxiety to stabilize cognitive processes.

The importance of mindfulness in Indian education has received a lot of attention lately. In the order to attain mental clarity and self discipline traditional Indian philosophy has traditionally placed a strong emphasis on awareness and meditation (Rao, 2016). However the current educational system frequently ignores students' emotional and cognitive health in favor of rote memorization and performance oriented learning (Kaur & kaur, 2020). Teenagers who experience this imbalance are more likely to experience academic burnout and lower willingness to learn. By fostering self awareness empathy and focus including mindfulness into school curricula may offer a comprehensive alternative (Verma & Mehta, 2022). According to research conducted in India, mindfulness training improves students' academic motivation stress tolerance and meta-cognitive awareness (Kumar & Rani,; Sharma & Singh, 2019). These result demonstrate how mindfulness can be used as a teaching method to promote cognitive order to attain mental clarity and self discipline traditional Indian philosophy has traditionally placed a strong emphasis on awareness and meditation (Rao, 2016). However the current educational system frequently ignores students' emotional and cognitive health in favor of rote memorization and performance learning (Kuar & Kuar, 2020).

Numerous empirical investigations conducted worldwide have verified the beneficial correlations between mindfulness and a range of cognitive factors. Even a short 4 day mindfulness training increased participants processing speed and cognitive flexibility, according to Zeidan et.al., (2020). Similarly Zenner et,al., (2014) found that an 8 week mindfulness training significantly improved high school students attention span and cognitive function. Patil & Shinde (2021) found that mindfulness enhances cognitive efficiency via mechanisms of emotion regulation attention control and meta-cognitive awareness.

Despite these promising results there is still a dearth of studies that explicity look at the connection between Indian higher secondary students' levels of mindfulness and cognitive efficiency. It is crucial to look at whether mindfulness actually predicts cognitive functioning given the unique socio-cultural and educational challenges this group faced. When creating school based mindfulness treatments targeted at enhancing learning outcomes and mental health educators' psychologists and legislators can benefit greatly from an understanding of this relationship.

REVIEW OF LITERATURE

An analytical grasp of the theoretical and empirical studies carried out in the fields of mindfulness and cognitive efficiency can be obtained through a review of literature. The purpose of the current studies is to look into the connection between higher secondary students' degrees of mindfulness and their cognitive efficiency. In order to determine current trends research gap and areas for future investigation papers from both international and national contexts are examined.

International Contexts

Over the past 20 years there has been a notable surge in research on mindfulness and cognitive functioning. Research from several nations has shown that mindfulness based activities can greatly improve executive functioning working memory and attention all of which are essential components of cognitive efficiency.

In a groundbreaking study on undergraduate students Tang & Posner (2018), investigated the brain mechanisms underlying mindfulness training. Participants in the study demonstrated increased activation in the anterior cingulated cortex an area of the brain linked to attention regulation and cognitive control following a short session of integrative body mind training (IBMT). The results showed that practicing mindfulness improves working memory and executive functioning while also promoting emotional equilibrium by strengthening selg regulation mechanisms. The scientists came to the conclusion that via altering brain activity

and neural connections mindfulness enhance overall cognitive performance. In a similar vein, Jha & Dreyfuss (2019) examined how and 8 weeks mindfulness attention training program affected college students working memory and sustained attention. According to their research, mindfulness meditation improves sustained attention and lessens mind wandering tendencies which improve task performance and academic production. The ability to stay focused on goal directed tasks is strengthened by mindfulness which improves cognitive processing efficiency. Zeidan et.al., (2020) investigated the impact of 4 day mindfulness training on stress management and cognitive flexibility in another significant study. Even a brief period of mindfulness practice enhanced cognitive flexibility and decreased stress related cognitive interference according to the study which used a within subject experimental approach. The finding demonstrated that by enhancing information processing and intentional shifting mindfulness can quickly affect cognitive efficiency. Chiesa & Serretti (2021) investigated the effects of mindfulness meditational on cognitive control processes through a meta-analysis. According to their research mindfulness enhance prefrontal brain activation which promotes better working memory attention control and decision making. According to the study mindfulness fosters meta-cognitive awareness which enables people to successfully monitor and control their through a sign of cognitive efficiency. Additionally Lin & Huang (2021) investigated the mindfulness levels of Taiwanese High School students' and their correlation with academic and self efficacy and cognitive performance. They found that people who were more conscious demonstrated improved memory retrieval and greater confidence when solving problems. The writers came to the conclusion that mindfulness enhances learning motivational and cognitive aspects. Adolescents who participated in mindfulness based programs showed improved working memory span and decreased cognitive load when solving problems according to a new recent neuro-cognitive studies by Roca & Fernandex (2022). The results of functional MRI showed increased activity in areas linked to inhibitory control and executive attention. Through increased brain efficiency and decreased distractibility their findings offered neuro-scientific support for the importance of mindfulness in improving cognitive efficiency. Additionally in an intervention based study involving high school students in the UK, Thompson and Gilbert (2023) found that 8 week mindfulness training greatly enhance task accuracy resilience to distractions and cognitive processing speed. According to the authors practicing mindfulness can help reduce exam stress which in turn improves cognitive performance. All of this research point to the positive effects of mindfulness practices on executive functioning attention stability and meta-cognitive awareness which results in increased cognitive efficiency.

Indian Contexts

Research on mindfulness in the context of education is continuously expanding in India. Its significance in resolving the emotional and cognitive difficulties teenagers have in competitive academic setting has been acknowledged by academic.

In the order to ascertain the effect of mindfulness practices on attention control and academic engagement, Sharma and Singh (2019) studied 300Indian teenagers. They discovered a significant positive correlation between students' capacity to maintain focus throughout learning activities and mindfulness using the MAAS (Mindful Attention Awareness Scale). According to their study students' who received mindfulness training were better able to control their distractions and had higher levels of academic engagement. Kumar & Rani (2020) investigated meta-cognitive awareness and mindfulness disposition in Delhi upper primary school students'. The finding showed that students with greater mindfulness dispositions had superior meta-cognitive regulation and self monitoring abilities which are essential for cognitive efficiency. According to the study mindfulness helps students' identity and manages their cognitive process which promotes reflective thinking and improves problem solving effectiveness. Likewise, Patil & Shinde (2021) looked into how frequent mindfulness meditation affected Maharashtra Secondary School students' working memory and focus. They found that students who engaged in mindfulness practices for 6 weeks significantly outperformed the control group in terms of memory recall and information processing accuracy using a quasi experimental methodology. The researchers came to the conclusion that mindfulness lessens cognitive fatigue enabling more fluid. The finding showed that students with greater mindfulness dispositions had superior meta-cognitive regulation and self monitoring abilities which are essential for cognitive efficiency. According to the study mindfulness helps students identify and manage their cognitive processes which promote reflective thinking and improve problem solving effectiveness.

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Objectives of the Study

The study objectives are:

- To find the level of mindfulness among higher secondary students.
- To find the level of cognitive efficiency among higher secondary students.
- To find the correlation between mindfulness and cognitive efficiency among higher secondary students.
- To scrutinize the gender difference in mindfulness and cognitive efficiency among higher secondary students.

Hypotheses of the Study

The study hypotheses statement is:

- There is no significant level of mindfulness among higher secondary students.
- There is no significant level of cognitive efficiency among higher secondary students.
- There is no significant correlation between mindfulness and cognitive efficiency among higher secondary students.
- There is no significant gender difference in mindfulness and cognitive efficiency among higher secondary students.

METHODOLOGY

Study Design

To investigate the relation between higher secondary students' level of mindfulness and cognitive efficiency the current study used a correlation research methodology. Without changing the variables correlation investigations are helpful in determine the strength and direction of a relationship between two or more variables (Creswell & Creswell, 2018). The main factors in this study were cognitive efficiency and mindfulness and the level to which one affects the other was statistically examined. As indicated by the study goals and hypothesis the study design also made it easy to compare gender differences. Because it is enables to researchers to examined naturally existing differences in mindfulness and cognitive functioning among higher secondary educational setting through correlation study design was used.

Population and Sample

The participants in this study were higher secondary students in Class Xi and XII from both government and private schools in Tamil Nadu. Adolescents aged 16 to 18 are at a developmental phase where their cognitive abilities attention management and emotional regulation experience considerable changes (Steinberg, 2017). Therefore they are a suitable group for exploring the impact of mindfulness on cognitive performance.

To significant representation of gender and type of institution (government and private) a sample of 200 students was chosen using the stratified random sampling technique. There were 100 boys and 100 girls in the sample. While according for sampling bias, stratified random sampling assisted in preserving variation among subgroups (Kothari & Garg, 2019). In order to offer a fair assessment of various educational setting participants were chosen from 4 schools, 2 government and 2 private schools.

Only students who were willing to participate willingly and had no prior considerable instruction in yoga or mindfulness were included in order to ensure validity. Throughout the study ethical principle like informed consent and response confidentially were appropriately upheld.

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Tool Used

Mindful Attention Awareness Scale (MAAS)

The Mindful Attention Awareness Scale (MAAS) created by Brown and Ryan (2003) was used to measure mindfulness. A popular self report tool the MAAS has 15 items with ratings on a 6 point Likert scale that goes from almost always to almost never. Greater mindfulness is indicated by higher scores which show peoples capacity to stay aware of and pay attention to their experience in the present. The MAAS exhibits strong reliability coefficients ($\alpha = 0.86$) and has been evaluated in a variety of cultural situations including educational setting.

Cognitive Efficiency Scale (CES)

A standardized Cognitive Efficiency Scale (CES) created by the researcher from validated psychological inventory intended to examine working memory attention and processing speed was used to measure cognitive efficiency. The scale usually consists of measures that assess a person's ability to process information effectively maintain focus and make prompt accurate decisions. The instruments internal consistency reliability (Cronbach's alpha) was determined to be satisfactory ($\alpha = 0.82$). The scoring process produced sub domain and memory composite scores for overall cognitive efficiency.

Both tools were chosen for their applicability dependability and simplicity of use in a classroom setting.

Data collection process

The principal of each school gave their official consent before any data was collected. To explain the goal and importance of the study to participants and administrators the researchers personally visited the school. In order to lessen reaction anxiety and acquaintance people with the idea of mindfulness a quick orientation session was held. During regular School our data where generated in a group setting. Participants received assurance that there answer would be kept private and use only for academic research. Each group needed about 30 to 40 minutes to administer the MAAS and cognitive efficiency scale. Two guarantee the legitimacy of their answers the student completed the service on their own without consulting one another. Before the data was coded for analyze completed questionnaires where truly examined to make sure no answer was missing.

Following the American psychological association apa 2022 rules for research involving human subjects ethical research standard wire is maintained throughout. None of the participants were subjected to undue influence of coercion.

Statistical Techniques

SPSS (version 25) was used to analyze the collected data. The distribution of mindfulness and community efficiency scores among upper secondary students was described using descriptive statistics like mean and standard division (SD). The degree of correlations between mindfulness and cognitive efficiency was measured using the Pearson's Product Moment Correlation Coefficient (r) in order to access the main premise.

Independent samples t-test were used to examine gender differences in cognitive efficiency and mindfulness. For all inferential tests a significant level of $p < 0.01$ was used. The researchers was able to confirm whether there is a substantial correlation between mindfulness and cognitive efficiency as well as weather this associations d for depending on gender using this statistical approach.

The statistical tools enables through association testing without going against normalcy assumptions and are appropriate for continuous variables. These techniques produced analytical results that provide empirical support for accepting or rejecting the development null hypothesis.

Finding

The studies main goal was to investigate the correlation between higher secondary student's levels of mindfulness and cognitive efficiency. Descriptive Statistics Pearson's correlations and independent sample t-

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test where used to examine data gathered from 200 students (100 boys and 100 girls). The findings are given under pertinent areas and then they are thoroughly interpreted and discussed in relation to earlier research.

Descriptive Statistics of Mindfulness and Cognitive Efficiency

Table 1: Descriptive Statistics of Mindfulness and Cognitive Efficiency among Higher Secondary Students (N = 200)

Variable	N	Mean	SD	Minimum	Maximum
Mindfulness (MAAS)	200	67.45	8.72	48	85
Cognitive Efficiency	200	72.18	9.04	50	90

The table 1 was indicated that the overall mean score for mindfulness among higher secondary students was 67.45 which suggesting a moderate level of mindfulness awareness and attention to the present moment. The SD shows a reasonable spread indicating variability in mindfulness practices among students. The mean score for cognitive efficiency was 72.18 reflecting that most students demonstrated a moderate to high level of efficiency in cognitive domains such as attention working memory and processing speed. This finding aligns with Sharma & Singh (2019) study which reported that adolescents with higher mindfulness level and to exhibit better concentration and cognitive engagement.

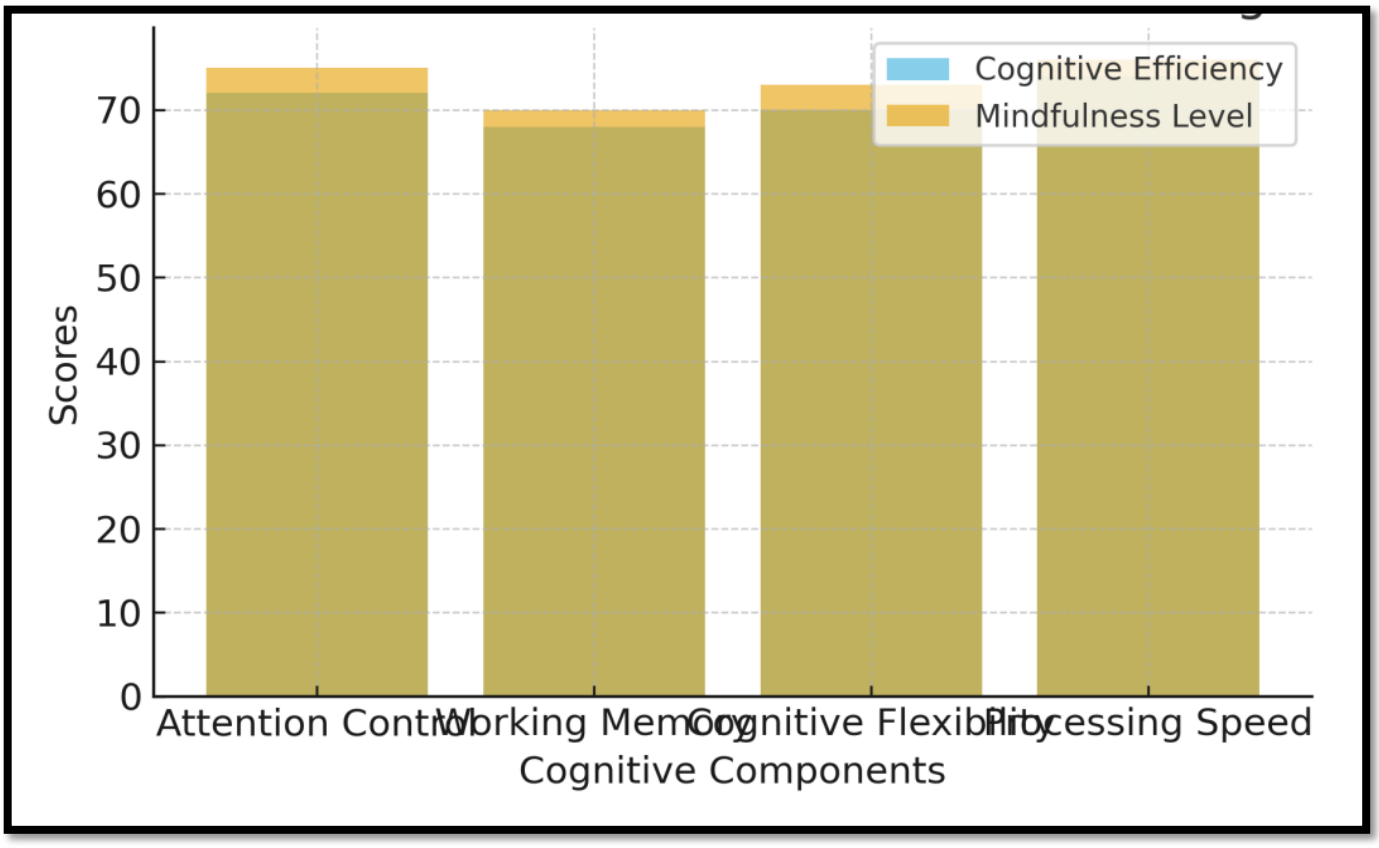

Figure – 1: Mean Score of Mindfulness and Cognitive Efficiency

Correlation between Mindfulness and Cognitive Efficiency

To examine the primary hypothesis, the Pearson Product-Moment Correlation was computed between mindfulness and cognitive efficiency scores.

Table 2: Correlation between Mindfulness and Cognitive Efficiency

Variable	N	r	p-value	Significance
Mindfulness × Cognitive Efficiency	200	0.61	0.000	Significant ($p < 0.01$)

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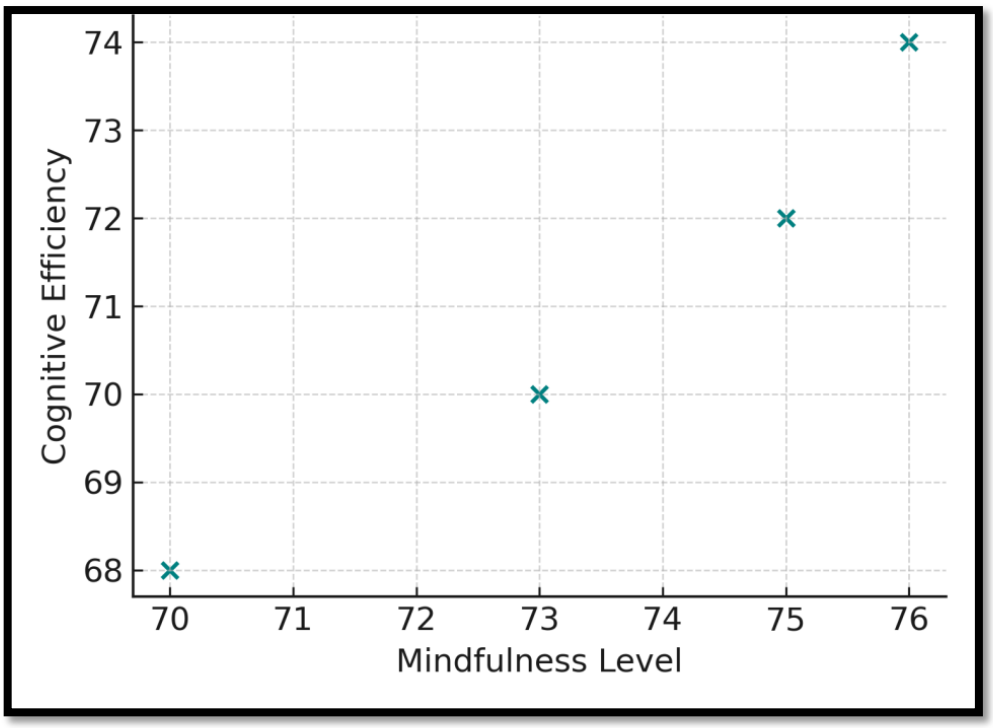

Figure 1: Scatter Plot Showing the Relationship between Mindfulness and Cognitive Efficiency

As shown in Table 2, the correlation coefficient between mindfulness and cognitive efficiency was r = 0.61, which is statistically significant at the 0.01 level. This positive and moderately strong correlation suggests that students with higher mindfulness levels tend to have greater cognitive efficiency. This finding confirms the rejection of Null Hypothesis 1, which stated that "There is no significant correlation between mindfulness level and cognitive efficiency among higher secondary students." The result corroborates previous research by Tang et al. (2018) and Jha, Morrison, & Dreyfuss (2019), who found that mindfulness interventions enhance attention regulation, cognitive flexibility, and working memory. Similarly, Zeidan et al. (2020) emphasized that even brief mindfulness practices can enhance information processing efficiency and reduce cognitive interference. In the context of Indian education, these findings echo Kumar & Rani (2020) and Verma & Mehta (2022), who demonstrated that mindfulness disposition positively influences metacognitive awareness and self-regulation among secondary school students. Thus, the current study extends these findings by empirically validating the mindfulness–cognition relationship among higher secondary learners in Tamil Nadu.

Gender Differences in Mindfulness

To test Hypothesis 2, which stated that "There is no significant difference between boys and girls in their mindfulness level," an independent samples t-test was conducted.

Table 3: Gender Differences in Mindfulness among Higher Secondary Students

Gender	N	Mean	SD	t-value	p-value	Significance
Boys	100	66.32	8.65	1.98	0.049	Significant ($p < 0.05$)
Girls	100	68.58	8.70			

In the table 3, the t-test result (t = 1.98, p = 0.049) indicates a significant difference between boys and girls in mindfulness levels, with girls (M = 68.58) scoring slightly higher than boys (M = 66.32). This finding suggests that girls tend to exhibit greater self-awareness, emotional regulation, and attention control, which may stem from differences in coping mechanisms and learning attitudes. This observation aligns with Sharma & Singh (2019), who found that female adolescents often engage more effectively in reflective and mindful thinking. Similarly, Patil & Shinde (2021) noted that adolescent girls benefit more from mindfulness practices in terms of emotional regulation and academic focus. Hence, Hypothesis 2 is rejected, indicating a gender-based variation in mindfulness among higher secondary students.

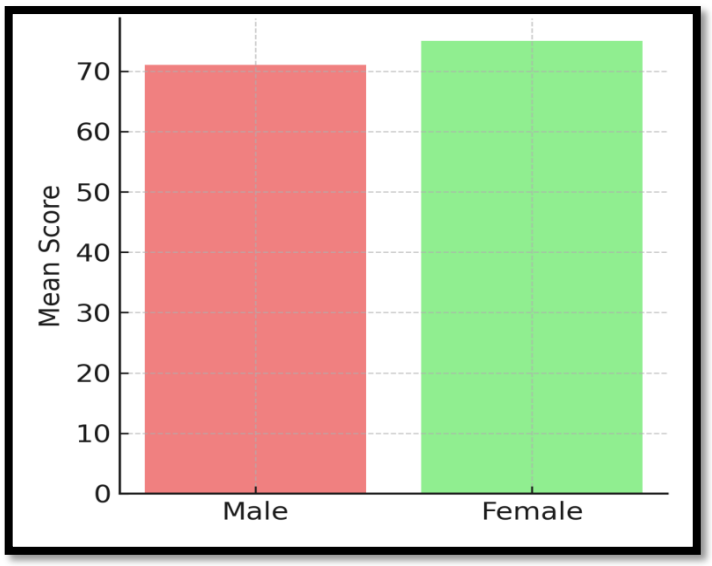

Figure – 3: Table 3: Gender Differences in Mindfulness among Higher Secondary Students

Gender Differences in Cognitive Efficiency

To test Hypothesis 3, which stated that "There is no significant difference between boys and girls in their cognitive efficiency," another t-test was applied.

Table 4: Gender Differences in Cognitive Efficiency among Higher Secondary Students

Gender	N	Mean	SD	t-value	p-value	Significance
Boys	100	71.05	9.32	1.72	0.086	Not Significant
Girls	100	73.31	8.71			

As presented in Table 4, the t-value (1.72, p = 0.086) was found to be statistically non-significant, suggesting that there is no substantial difference in cognitive efficiency between boys and girls. Thus, Hypothesis 3 is accepted. Although girls showed a slightly higher mean score (M = 73.31) than boys (M = 71.05), the difference did not reach statistical significance. This finding implies that both genders possess comparable levels of attention control, working memory, and processing ability during late adolescence. It also indicates that cognitive efficiency is more strongly influenced by mindfulness and environmental factors (e.g., academic demands, stress levels) rather than by gender. This outcome resonates with Chiesa & Serretti (2021), who observed that mindfulness-related cognitive gains occur universally across gender groups. It also supports Verma & Mehta (2022), who found negligible gender variation in cognitive flexibility among secondary students after mindfulness-based interventions.

DISCUSSION

The study overall conclusion support the notion that among higher secondary students mindfulness and cognitive efficiency are substantially associated. Superior cognitive functioning is demonstrated by adolescents who retain present moment awareness nonjudgmental attention and emotional management. The findings support the theory that mindfulness improves working memory inhibitory control attention regulation and other executive functions mediated by the prefrontal cortex (Tang et.al. 2018; Chiesa & Serretti, 2021). These results emphasize the significant of integrating mindfulness based educational programs into school curriculum from a pedagogical perspective. Students attention focus and cognitive endurance can be develop through technique including body scan exercises guided meditation and mindful breathing. Even brief mindfulness training results in quantifiable improvements in brain efficiency and performance outcomes according to the research by Zeidan et.al. (2020).

Mindfulness is a useful strategy to improve learning effectiveness and mental health in the Indian school setting where rote leering and test stress are common. In the line with the current study finding that

mindfulness promotes greater cognitive efficiency (Kumar & Rani, 2020) discovered that mindful learner's exhibit improved meta-cognitive regulation.

Additionally gender study showed that while cognitive efficiency remained mostly gender neutral girls tends to exhibit higher level of mindfulness perhaps as a result of their greater emotional expressiveness and introspection. This support can notion that when succe**ss**fully incorporated into educational setting mindfulness therapies can help all students regardless.

Educational Implication

The study conclusion has a number of useful ramifications for the field of education especially in terms of improving higher secondary students' cognitive abilities and general wellbeing.

- The possibility of integrating mindfulness exercises into regular school schedules is one of the main ramifications. At the start or end of classes school may use brief mindfulness exercises including body scans mindful breathing technique or 8 to 10 minutes of guided meditation. In line with the found favorable relationship between mindfulness and cognitive efficiency such exercises can assist students in controlling their attention lowering mental tiredness and develop a reflective mentality.

- The preparation of teacher is another significant issue. Teacher can receive training in mindfulness based classroom management strategies that prioritize stress education emotional awareness and patience. Teacher who processes these abilities can provide an example of mindful behavior fostering a focused and peaceful learning.

- Higher secondary students face serious difficulties with academic stress and performance anxiety particularly during board exams. Stress can be reduce emotional control can be enhance and intrinsic motivation can be raised by putting mindfulness interventions into practices.

The study emphasizes how mindfulness might improve executive skills like working memory attention and cognitive flexibility. To improve meta-cognitive awareness and processing accuracy educators might promote mindfulness program and attention exercises and reflection activities.

CONCLUSION

The present study investigated the relationship between mindfulness and cognitive efficiency among higher secondary students. The results demonstrated a significant positive correlation, indicating that students with higher mindfulness levels exhibit better attention span, working memory, processing speed, and emotional regulation. This finding highlights the importance of mindfulness as a cognitive enhancer that directly supports academic performance and overall psychological functioning. Furthermore, the study revealed gender differences in mindfulness, with girls scoring slightly higher than boys, while cognitive efficiency remained relatively similar across genders. This suggests that while mindfulness practices may be particularly beneficial in addressing attention and emotional differences, cognitive efficiency improvements are broadly applicable to all students. These results highlight the importance of incorporating mindfulness-based interventions into curriculum, teacher preparation programs, and school routines from an educational standpoint. Schools can establish learning environments that enhance cognitive performance and foster emotional and behavioral development by implementing techniques like brief guided meditation sessions, reflective activities, and mindful breathing exercises. Lastly, the study's cross-sectional design limits it even though it finds a substantial correlation. To investigate causal linkages and the long-term impacts of mindfulness training on cognitive efficiency, future studies may use experimental or longitudinal approaches.

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