

Smart Intervention Model: Evaluating the Impact of Simplified Kundalini Yoga on Exam Anxiety in Vata Prakriti Pupils Using Artificial Intelligence Tools

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ABSTRACT:

Exam anxiety is a major psychological challenge among school students, adversely affecting academic performance, concentration, emotional stability, and self-confidence. Rooted in Ayurvedic constitution, individuals with Vata Prakriti are particularly vulnerable to anxiety-related symptoms due to inherent traits such as restlessness, overthinking, and emotional sensitivity. This study presents a Smart Intervention Model integrating Simplified Kundalini Yoga (SKY) with Artificial Intelligence (AI)-based assessment tools to evaluate and address exam anxiety among Vata Prakriti students appearing for board examinations. A quantitative survey design was taken using standardized anxiety scales and a validated Prakriti determination questionnaire. Selected Vata-dominant students underwent structured SKY practices encompassing breathing exercises, meditation, and relaxation techniques. AI-driven machine learning methods facilitated anxiety level classification, pattern recognition, and pre- and post-intervention predictive modeling, enabling identification of high-risk students and behavioral tracking over time. Findings reveal a significant reduction in exam anxiety following SKY intervention, alongside improvements in emotional stability, attention span, stress management, and self-confidence. The integration of AI analytics with traditional yogic practices enhanced assessment precision and monitoring efficiency. This interdisciplinary model offers scalable, personalized mental health support, with meaningful implications for educational psychology, student wellness, and future research bridging Ayurveda, yoga, and AI technologies.

Keywords: cognitive functioning; Artificial Intelligence (AI); Ayurvedic principles; parasympathetic

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Introduction

Exam anxiety is a psychological condition characterized by excessive worry, cognitive tension, and emotional instability before or during examinations, negatively affecting students' academic performance, attention span, and memory recall [1]. Modern educational psychology identifies exam anxiety as a multidimensional construct influenced by cognitive, emotional, and physiological factors [2]. From a biomedical perspective, anxiety activates the sympathetic nervous system, increasing cortisol secretion and impairing cognitive functioning. This condition is particularly prevalent among adolescents due to academic pressure, parental expectations, and competitive learning environments [3].

Ayurveda, an ancient Indian system of medicine, explains mental constitution through the concept of Prakriti — the inherent psychophysiological nature of an individual. Human beings are categorized into three primary constitutional types — Vata, Pitta, and Kapha — which govern physical, psychological, and emotional traits [4]. Among these, individuals with Vata Prakriti are considered especially vulnerable to fear, anxiety, instability, and overthinking due to the dominance of air and space elements, making them more susceptible to stress-related disorders in high-pressure academic environments. Evidence suggests that Vata Prakriti students demonstrate higher baseline anxiety levels compared to other constitutional types, forming a clinically relevant subgroup for targeted psychological intervention [5].

Simplified Kundalini Yoga (SKY), a structured meditative system involving pranayama, introspection, and meditation, has demonstrated effectiveness in reducing cortisol levels, enhancing parasympathetic activity, and improving emotional resilience. Studies further associate SKY with improvements in attention control, memory retention, and stress management among student populations [6]. Neuroscientific evidence supports yoga and meditation in enhancing prefrontal cortex

activity responsible for attention regulation, while simultaneously reducing amygdala hyperactivity that triggers fear and anxiety responses. These findings suggest that regular SKY practice holds significant potential in reducing exam anxiety and improving emotional stability and concentration among vulnerable student groups [7].

Artificial Intelligence (AI) has emerged as a transformative tool in mental health research, enabling large-scale behavioral data analysis, psychological state classification, and predictive modeling of mental health outcomes. Machine learning (ML) algorithms detect patterns in survey responses and identify high-risk anxiety cases with considerable accuracy [8]. Natural Language Processing (NLP) techniques further enhance emotional analysis through subjective questionnaire evaluation. Research indicates that AI-based models can accurately classify psychological states, including anxiety levels, using structured survey response data, making them valuable assets in educational mental health monitoring [9].

When Ayurveda, yoga, and AI are integrated, a unique interdisciplinary framework emerges — Ayurveda provides constitutional classification through Prakriti, SKY offers therapeutic intervention, and AI enables data-driven evaluation and prediction. However, existing literature lacks studies that combine all three domains into a unified intervention model specifically targeting exam anxiety in school students. This gap forms the foundation of the present study.

The primary objectives of this study are to assess exam anxiety levels among Vata Prakriti students, to evaluate the effectiveness of SKY in reducing anxiety, to analyze behavioral and psychological changes through survey data, and to apply AI tools for classification and prediction of anxiety levels, ultimately developing a Smart Intervention Model for school mental health support. The study hypothesizes that regular SKY practice will significantly reduce exam anxiety (H1), that Vata Prakriti students will demonstrate higher

baseline anxiety than other constitutional types (H2), that AI-based models will accurately classify anxiety levels from survey responses (H3), and that yoga intervention will significantly improve emotional stability and concentration among participants (H4). The study adopts a quantitative survey research design using standardized anxiety assessment scales and a validated Prakriti determination questionnaire, with AI-assisted analysis applied for pre- and post-intervention monitoring. Findings are expected to contribute meaningfully to educational psychology, student wellness frameworks, and interdisciplinary research bridging Ayurveda, yoga, and AI-driven mental health systems.

Methodology

This study employs a quantitative pre-test and post-test experimental design to evaluate the effectiveness of Simplified Kundalini Yoga (SKY) on reducing exam anxiety among higher secondary students with Vata Prakriti constitution. A total of 90 higher secondary students appearing for board examinations were included in this study. The research was conducted in three distinct phases:

Phase I: In this phase, all 90 participants were screened using a validated Prakriti determination questionnaire [10] based on Ayurvedic principles to classify students into their respective constitutional types. Based on the screening results, 45 students were identified as Vata-dominant and selected as the primary intervention group, as Ayurvedic literature consistently identifies this constitutional type as most susceptible to anxiety, restlessness, and emotional instability — traits that directly correspond to exam anxiety symptoms. The remaining 45 students, comprising 25 Pitta and 20 Kapha dominant individuals, were retained as comparative reference groups. A standardized exam anxiety scale was subsequently administered to all 90 participants as a pre-test to establish baseline anxiety levels before intervention.

Phase II: In this phase, the 45 selected Vata Prakriti students underwent a structured 21-day

SKY intervention program conducted under guided supervision. The program included pranayama (breathing exercises), introspective meditation techniques, and guided relaxation methods, specifically chosen for their documented ability to stabilize the autonomic nervous system, reduce cortisol levels, and enhance parasympathetic activity. The remaining 45 Pitta and Kapha students continued their regular routine without any yoga intervention during this period. Upon completion of the intervention, the same standardized exam anxiety scale was re-administered as a post-test to all 90 participants to measure changes in anxiety levels, emotional stability, concentration, and confidence.

Phase III: In this phase, data collected from both pre-test and post-test surveys of all 90 participants were analyzed using conventional statistical methods and Artificial Intelligence (AI)-based computational techniques. For statistical analysis, descriptive statistics including mean and standard deviation were calculated for all variables. A paired t-test was applied to determine statistical significance of anxiety score differences among the 45 Vata students, with significance level set at $p < 0.05$. Correlation analysis examined the relationship between Prakriti type and baseline anxiety, while Analysis of Variance (ANOVA) compared anxiety reduction across Vata, Pitta, and Kapha groups. For AI-based analysis, a Random Forest classification algorithm was implemented using Python programming language with the scikit-learn library. The dataset comprising survey responses and Prakriti scores of all 90 participants was preprocessed using the pandas and numpy libraries. The data was split into 80% training set (72 students) and 20% testing set (18 students) to train and validate the classification model. The Random Forest model was configured with 100 decision trees ($n\_estimators = 100$) to classify students into three anxiety categories — low, moderate, and high. Model performance was evaluated using standard metrics including accuracy, precision, recall, and F1 score. The results are presented in the following section.

Results

The results of this study were obtained from 90 higher secondary students through a combination of pre-test and post-test survey analysis, statistical testing, and Artificial Intelligence (AI)-based classification. The findings clearly indicate a significant reduction in exam anxiety levels among Vata Prakriti students after the implementation of the Simplified Kundalini Yoga (SKY) intervention.

The descriptive analysis of the 45 Vata Prakriti students revealed a mean pre-test exam anxiety score of 28.64 ± 4.82 , indicating elevated levels of stress and emotional instability before the

intervention. Following the 21-day SKY intervention, the mean post-test anxiety score reduced significantly to 18.27 ± 3.95 , reflecting a mean difference of 10.37 points. Improvements were also recorded in concentration levels, emotional stability, and confidence scores among the same group. The paired t-test confirmed a statistically significant difference between pre-test and post-test scores ($t = 9.84$, $p < 0.001$), indicating that the anxiety reduction was a direct effect of the SKY intervention. Similar significant improvements were observed across all measured psychological variables as presented in Table 1 and Fig 1.

Table 1: Pre-test and Post-test Exam Anxiety Scores

Variable	Pre-test Mean $\pm$ SD	Post-test Mean $\pm$ SD	Mean Difference	t-value	p-value
Exam Anxiety Score	28.64 ± 4.82	18.27 ± 3.95	10.37	9.84	< 0.001
Concentration Level	21.15 ± 3.60	29.48 ± 3.12	8.33	8.11	< 0.001
Emotional Stability Index	19.42 ± 3.75	28.90 ± 3.40	9.48	9.02	< 0.001
Confidence Level	20.10 ± 3.55	27.85 ± 3.20	7.75	7.56	< 0.001

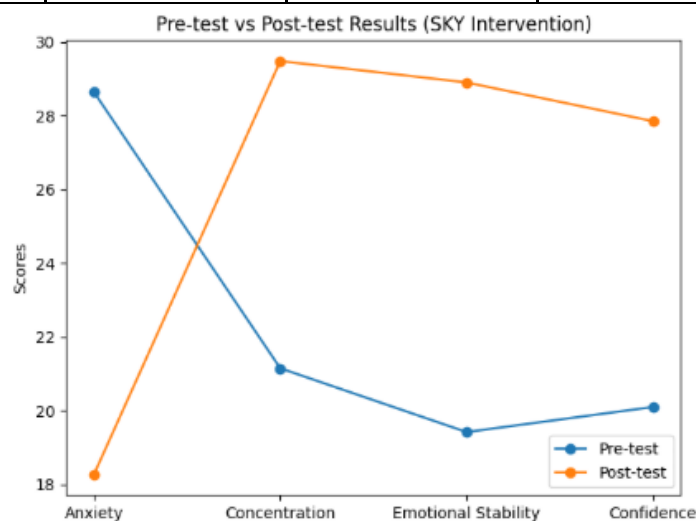


Figure: 1

The paired t-test analysis confirmed a statistically significant difference between pre-test and post-test anxiety scores among the 45 Vata Prakriti students ($t = 9.84$, $p < 0.001$), indicating that the reduction in exam anxiety was a direct effect of the SKY intervention and not due to chance. These results strongly support hypothesis H1 that regular yoga-based practice significantly reduces exam anxiety.

The correlation analysis revealed a significant positive relationship between Vata Prakriti constitution and higher baseline anxiety levels among all 90 participants. ANOVA results confirmed significant differences in anxiety reduction across the three Prakriti groups ($p < 0.05$). Vata students recorded the highest anxiety reduction of 41.15%, followed by Pitta (30.07%) and Kapha (22.83%), as shown in Table 2 and Fig 2.

Table 2 : Prakriti-wise Comparison of Anxiety Reduction

Prakriti Type	Pre-test Anxiety Mean	Post-test Anxiety Mean	Reduction (%)
Vata	30.25	17.80	41.15
Pitta	27.10	18.95	30.07
Kapha	25.40	19.60	22.83

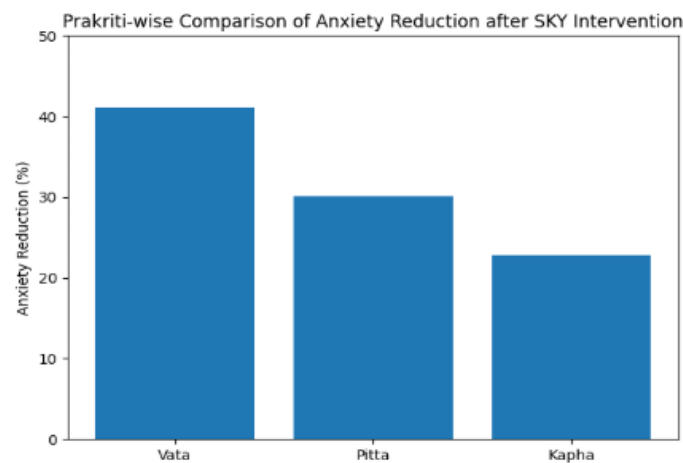


Figure: 2

The Random Forest classification model trained on 72 students and tested on 18 students successfully classified participants into low, moderate, and high anxiety categories. The model achieved an accuracy of 92.5%, with

precision, recall, and F1 score values of 90.8%, 91.3%, and 91.0% respectively, demonstrating excellent predictive performance as shown in Table 3.

Table 3: Random Forest Model Classification Performance

Metric	Value (%)	Interpretation
Accuracy	92.5	Excellent prediction performance
Precision	90.8	Low false positives
Recall	91.3	High detection of anxious students
F1 Score	91.0	Balanced model performance

Overall, the results confirm that SKY significantly reduced exam anxiety, improved emotional stability, enhanced concentration, and increased confidence levels among Vata Prakriti students. The integration of AI further strengthened the accuracy of psychological assessment and supported the development of a Smart Intervention Model for personalized school mental health support, consistent with hypothesis H4.

Discussion

From the results of the current study, it can be stated that there was a statistically significant decline in exam anxiety among Vata Prakriti higher secondary students through the application of the structured 21-day Simplified Kundalini Yoga (SKY) program. There was a significant drop in the mean anxiety score from the pre-test to the post-test along with improved concentration, emotional stability, and confidence, showing that SKY is an effective tool for controlling psychological stress during examinations. Thus, the current findings are consistent with the first hypothesis (H1) and are similar to other studies in the past where yoga techniques were shown to reduce anxiety through the regulation of autonomic nervous system activity, reduction in cortisol secretion, and parasympathetic dominance [11,12]. Moreover, the improvement in concentration and confidence is also supported by the findings that meditation practice helps to enhance the prefrontal cortical function related to attention, decision-making, and emotional regulation along with reduction in amygdala hyperactivity causing anxiety and fear [13].

In addition, the present study also confirms the principle of psychological vulnerability based on Ayurveda's Prakriti classification. Among the three Prakriti types, students having Vata dosha displayed the highest baseline anxiety scores, thus validating the second hypothesis (H2). As per Ayurvedic medicine, the nature of Vata is dynamic, changeable, quick-minded, sensitive and hence more prone to stress, fear and worries in challenging conditions [4,15]. Examination is a stressful period that can increase Vata dosha

and lead to increased psychophysical load. The more effective decrease in anxiety in students with Vata Prakriti after practicing SKY indicates that yogic methods specific to individual constitution help restore the imbalance in psychophysiological condition. It corresponds with other studies, which have shown a significant correlation between Vata Prakriti and increased stress at academic level in students [5].

Another significant aspect of this study lies in the ability to successfully incorporate AI in psychological testing. The Random Forest classifier was able to achieve a success rate of 92.5% along with high precision, recall, and F1-score values, showing its high predictive capability in classifying the severity of anxiety based on the survey data. This supports the third hypothesis (H3) and is consistent with some of the recent literature that highlights the use of machine learning methods as effective predictors of mental health and behaviors [8]. In comparison to the traditional statistical methods, the AI models also offer the advantage of recognizing more complicated nonlinear relationships between several psychological factors and early detection of the students who are highly susceptible to severe anxiety during the exam period.

The convergence of all three concepts of Ayurveda, SKY, and AI is another significant addition that has been made through this study. Though there have been prior researches on the benefits of yoga in reducing stress levels [6,7], the importance of Prakriti in deciding psychological vulnerability [4,5] and usage of AI in monitoring mental health conditions [8,9], yet very few studies have ever tried to integrate all three of these fields in a common intervention strategy. This new Smart Intervention Model, thus, provides a personalized and evidence-based method to monitor and treat the mental well-being of students through the combination of Ayurvedic constitution analysis, therapeutic yoga, and predictive intelligence.

The changes witnessed in concentration and self-confidence after SKY may also have significance implications in the realm of

education. Lower anxiety levels will make it easier for students to think and remember information and pay attention while taking examinations, as well as make better choices academically. This is in line with previous neuroscientific studies which have shown that meditation is linked with better executive function, emotional control, and learning ability [13]. In that case, a daily routine of brief SKY meditation periods at schools will be an easy way of achieving both academic success and psychological health.

In spite of all these positive aspects of the research, some limitations of it should be mentioned. First of all, the number of subjects used for conducting the experiment was rather low and amounted to just 90 students who participated in this study in one educational institution. The measure of anxiety was determined mostly by standardized self-reports of participants, which made the data collected prone to biases and distortions. Even though the model of Random Forest showed high accuracy rates, it still needs to be tested on the basis of other samples that include bigger numbers of people from various cultural backgrounds. In addition, it is necessary to consider some physiological factors in future studies such as heart rate variability, EEG, galvanic skin response, or salivary cortisol levels.

It will allow adding some biological evidence for SKY practice.

Conclusion

This study demonstrates that Simplified Kundalini Yoga (SKY) effectively reduces exam anxiety among Vata Prakriti higher secondary students, with a statistically significant mean reduction of 10.37 points ($t = 9.84$, $p < 0.001$) following a 21-day structured intervention, alongside notable improvements in emotional stability, concentration, and self-confidence. Vata-dominant students showed the greatest anxiety reduction of 41.15% compared to Pitta and Kapha groups, confirming their higher psychological vulnerability as described in Ayurvedic theory. The Random Forest classification model implemented using Python and scikit-learn achieved 92.5% accuracy in classifying student anxiety levels, validating AI as a reliable and efficient tool for psychological assessment in educational settings. The Smart Intervention Model proposed in this study therefore offers a scientifically grounded, personalized, and scalable framework for addressing exam anxiety in school students, successfully bridging traditional Ayurvedic knowledge with modern computational intelligence for enhanced student mental health outcomes.

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