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Enhancing Student Performance through Fuzzy MCDM: Evaluating Family Concern, Study Environment, and other Key Factors

Dr.Amsraj[1], Dr. S. DEEPA[2], Dr.S.P.Sathiyapriya[3], Dr. Gaurav Khanna[4], Dr.G.Sureshkrishna[5], M.Indhumathi[6], Dr.Sk Mastan[7], V. Manopriya[8]

[1]*Assistant Professor, Department of Tamil, United College of Arts and Science, Coimbatore*
[2]*Assistant Professor, Department of Mathematics, Easwari Engineering College*
[3]*Assistant Professor, Department of Mathematics, Kumaraguru College of Technology, Coimbatore*
[4]*Assistant Professor, School Of Legal Studies, Global Group of Institutes*
[5]*Assistant Professor (SS), Faculty of Management Studies, Periyar Maniammai Institute of Science & Technology (Deemed to be University), Thanjavur*
[6]*Assistant Professor, Department of Mathematics, R.B.Gothi Jain College for Women, Redhills*
[7]*Associate professor,Department of Mathematics, Ramireddy subbrami Reddy Engineering College, Kadanuthala, Kavali,spsr Nellore – 524142*
[8]*Assistant Professor, Department of Commerce, United College of Arts and Science, Coimbatore*

Abstract: ***In this study, the Fuzzy Analytic Hierarchy Process (FAHP) was utilized to evaluate factors affecting student well-being and performance. The criteria assessed included C1 - Family Concern, C2 - Environment of Study, C3 - Resources, C4 - Time Management, and C5 - Lecturer Concern. A survey was administered to students at United College of Arts and Science in Coimbatore, Tamil Nadu, India, to gather numerical data. Pairwise comparison matrices were created based on the survey responses to assess the relative importance of each criterion. The FAHP analysis revealed that Family Concern (C1) has the greatest impact on student outcomes, highlighting the crucial role of family support in student success and well-being. The findings suggest that educators and parents should prioritize addressing family-related issues and consider implementing additional supportive measures, such as yoga and sports activities, to further improve student performance and overall well-being.***

Keywords: Fuzzy Analytic Hierarchy Process (FAHP), , Stress Factors, Yoga and Sports Activities, Decision-Making, Criteria

I. INTRODUCTION

In the education sector, stress factors are multifaceted and significantly impact both students and educators. For students, academic pressure, time management challenges, family expectations, and financial concerns are prominent sources of stress. The pressure to excel academically, coupled with the difficulty of balancing school with extracurricular activities and personal life, often leads to heightened anxiety and burnout. Family expectations regarding academic success and career paths can further exacerbate stress levels. Financial burdens related to education costs also contribute to students' financial stress. Additionally, inadequate support systems, including limited access to mental health resources and counseling services, can leave students feeling unsupported.

Educators are not immune to stress either; they face pressures from high expectations, heavy workloads, and administrative responsibilities, which can impact their ability to support students effectively. Social and peer pressures also play a role, affecting students' mental health and academic performance. Despite the recognition of these stress factors, research gaps persist. There is a need for more in-depth studies on the impact of family dynamics and longitudinal research on the long-term effects of stress. The effectiveness of various stress-reduction interventions, such as yoga and counseling, requires further investigation, particularly across different cultural and regional contexts. Additionally, the impact of teacher stress on student outcomes and the role of digital technology in contributing to stress have not been fully explored. Addressing these gaps can provide a clearer understanding of stress in education and lead to more effective support systems and interventions.

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II. LITERATURE REVIEW

Baker & McGowan (2019): This systematic review identifies academic pressure, time management issues, family expectations, and financial concerns as primary sources of stress for students, highlighting the need for effective coping strategies. Borg & Riding (1991): The review reveals that high expectations, heavy workloads, and administrative responsibilities are significant stressors for educators, affecting their professional performance and well-being. Chen & Wei (2019): The study explores stress and coping mechanisms among college students, emphasizing the impact of academic demands and time management challenges on their mental health. Havenga & Grobbelaar (2020): This review examines the relationship between academic stress, self-esteem, and performance, revealing that high stress negatively affects students' academic achievements and overall well-being. Hsu & Wang (2016): The research focuses on the effects of academic stress on college students' mental health, noting that stress significantly impairs students' emotional and psychological states. Kumar & Bhukar (2019): The review discusses how teacher stress impacts student outcomes, finding that elevated stress levels among teachers can adversely affect student performance and classroom dynamics. Lazarus & Folkman (1984): This foundational text on stress, appraisal, and coping provides theoretical frameworks for understanding how individuals perceive and manage stress, influencing subsequent research in educational settings. McCormick & Tassell (2021): The study highlights how teacher stress affects students' academic performance and mental health, suggesting that teacher well-being is crucial for student success. Miller & Bixby (2015): This review addresses how family dynamics, including expectations and support, significantly impact student stress and academic performance.

Misra & Castillo (2004): The comparison of stress levels among international and U.S. students reveals cultural variations in stressors and coping mechanisms, emphasizing the need for context-specific support. Pietarinen, Pyhältö, & Soini (2017): The review of educator stress and well-being suggests that integrated support systems, including academic advising and mental health resources, are essential for managing stress effectively. Raj & Kaur (2018): This study explores the relationship between financial stress and academic performance, finding that financial burdens significantly impact students' focus and academic outcomes. Rosenberg & Rosenberg (2016): The meta-analysis on stress and academic achievement highlights the complex relationship between stress levels and students' educational performance. Schafer & Wiese (2020): The evaluation of stress-reduction interventions in educational settings indicates mixed effectiveness, pointing to the need for further research on optimal intervention strategies. Venugopal, R., et al, 2024. Zeidner & Matthews (2016): The review discusses stress and resilience in educational contexts, emphasizing the importance of understanding stress factors and developing effective support systems.

A. Research Gaps

1) *Longitudinal and Contextual Understanding:* There is a need for long-term studies to explore how stress impacts students' academic performance and mental health over time. Additionally, research should investigate how stress factors vary across different cultural and regional contexts, including non-Western settings.
2) *Effectiveness of Interventions:* While stress-reduction interventions like yoga, mindfulness, and counseling are widely implemented, there is a lack of comprehensive studies evaluating their effectiveness in various educational environments and among diverse student populations.
3) *Teacher Stress and Digital Technology:* Further research is needed to understand how teacher stress affects student outcomes and how digital technology, including social media and online learning tools, contributes to student stress levels. Addressing these areas could lead to more effective support strategies and better management of technological stressors.

III. FUZZY ANALYTIC HIERARCHY PROCESS (FUZZY AHP)

The Analytic Hierarchy Process (AHP), introduced by Thomas L. Saaty in 1980, simplifies complex decision-making by structuring it into a hierarchical model and employing pairwise comparisons to establish priority scales. To address the uncertainty in judgments, this method has been enhanced with Triangular Fuzzy Numbers (TFNs), allowing for a more flexible and nuanced evaluation.

1) Developing a fuzzy comparison matrix

First the scale of linguistics is determined. The scale used is the TFN scale from one to nine are shows in Table 1.

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Table 1. Scale of Interest

Scale of Interest	Linguistic Variable	Membership Function
1	Equally important	(1,1,1)
3	Weakly important	(2,3,4)
5	Strongly more important	(4,5,6)
7	Very strongly important	(6,7,8)
9	Extremely important	(8,9,10)

Then, using the TFN to make pair-wise comparison matrix for the main criteria and sub-criteria.
Equation (1) shows the form of fuzzy comparison matrix.

$$\bar{\mathcal{A}} = \begin{bmatrix} 1 & \cdots & \overline{a_{1n}} \\ \vdots & \ddots & \vdots \\ \overline{a_{n1}} & \cdots & 1 \end{bmatrix} \quad (1)$$

2) Define Fuzzy Geometric Mean

The fuzzy geometric mean is then calculated using Equation (2)[13]:

$$\bar{x_i} = \left(\bar{a}_{(i1)} \otimes \bar{a}_{(i2)} \otimes \ldots \otimes \bar{a}_{(in)}\right)^{\frac{1}{n}} \quad (2)$$

Where $\tilde{a}_{in}$ is a value of fuzzy comparison matrix from criteria I to n. Result from the fuzzy geometric mean will be referred to later as local fuzzy number.

3) Calculate the weight of fuzzy of each dimension

The next step is to calculate the global fuzzy number for each evaluation dimension with Equation (3).

$$\tilde{w}_i = \tilde{x}_1 \otimes (\tilde{x}_1 \oplus \tilde{x}_1 \oplus \ldots \oplus \tilde{x}_1)^{-1} \quad (3)$$

4) Define the best non fuzzy performance (BNP)

The global fuzzy number is then converted to crisp weight value using the Centre of Area (COA) method to find the value of best BNP from the fuzzy weight in each dimension, calculated using Equation (4).

$$BNP_{wi} = \frac{[(u_{wi} - l_{wi}) + (m_{wi} - l_{wi})]}{3} + l_{wi} \quad (4)$$

A. Case study

A numerical survey was conducted with students from United College of Arts and Science in Coimbatore, Tamil Nadu, India, to gather data for analysis. The collected data were reviewed by experts with over 30 years of teaching experience to facilitate the pairwise comparison process. The study examined various criteria, including C1 - Family Concern, C2 - Environment of Study, C3 - Resources, C4 - Time Management, and C5 - Lecturer Concern. The Fuzzy Analytic Hierarchy Process (FAHP) was used to determine the relative weights of these criteria, with the FAHP values presented in Table 1.

Table 1: Determining the weights of the criteria by FAHP Approach

Criteria	C_1	C_2	C_3	C_4	C_5
Fuzzy Weights	0.2302	0.2248	0.2090	0.1901	0.1463
Rank	1	2	3	4	5

IV. CONCLUSION AND FUTURE WORK

This study employed the Fuzzy Analytic Hierarchy Process (FAHP) to assess factors affecting student well-being and performance at United College of Arts and Science in Coimbatore, Tamil Nadu, India. The FAHP analysis considered criteria including Family Concern, Environment of Study, Resources, Time Management, and Lecturer Concern, and found that Family Concern had the most significant impact on student outcomes. According to the FAHP method, Family Concern (C1) was ranked highest, indicating that family support is crucial for student success.

The results suggest that students increasingly require dedicated time for sports and yoga as part of their college experience. Therefore, it is recommended that educators and parents focus on addressing family-related issues and incorporate additional supportive measures such as organized yoga and sports activities.

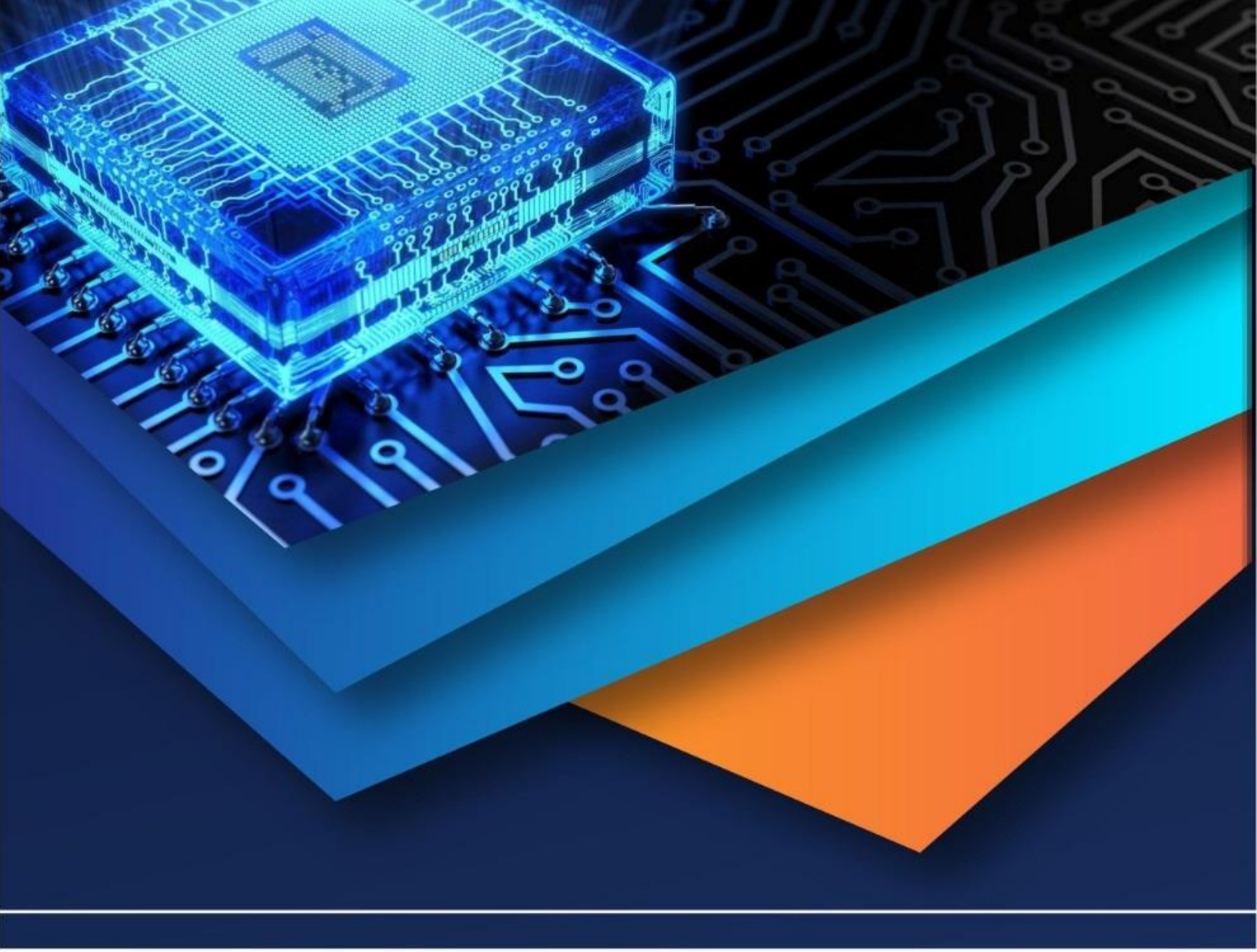
Implementing these initiatives could enhance student performance and overall well-being, underscoring the need for a comprehensive approach to student support in both academic and personal domains.

Future research could explore longitudinal studies to track the long-term impact of family concern and other factors on student outcomes. Evaluating the effectiveness of specific interventions, such as sports and yoga programs, could provide insights into their impact on student well-being. Expanding research to include diverse cultural and regional contexts would help tailor support strategies more effectively. Additionally, investigating the role of digital tools in supporting student well-being and integrating broader criteria could offer a more comprehensive understanding of factors influencing student success.

REFERENCES

[1] Baker, C. R., & McGowan, B. C. (2019). "Stress among students: A systematic review of literature." International Journal of Education and Psychological Research, 8(1), 15-23.
[2] Borg, M. G., & Riding, R. J. (1991). "Stress in teaching: A review of the literature." Educational Research, 33(3), 139-146.
[3] Chen, F. C., & Wei, C. M. (2019). "Exploring stress and coping mechanisms among students in higher education." Journal of College Student Development, 60(6), 729-743.
[4] Havenga, Y., & Grobbelaar, M. (2020). "Academic stress, self-esteem, and academic performance: A systematic review." South African Journal of Higher Education, 34(3), 101-122.
[5] Hsu, H. C., & Wang, S. M. (2016). "The effects of academic stress on college students' mental health." Journal of Educational Psychology, 108(4), 671-681.
[6] Kumar, S., & Bhukar, M. (2019). "Teacher stress and its impact on student outcomes: A review of literature." Educational Psychology Review, 31(1), 103-125.
[7] Lazarus, R. S., & Folkman, S. (1984). "Stress, Appraisal, and Coping." Springer Publishing Company.
[8] McCormick, M. P., & Tassell, J. C. (2021). "Teacher stress and its impact on students' academic performance and mental health." Journal of School Health, 91(7), 590-600.
[9] Miller, S. K., & Bixby, P. (2015). "The role of family dynamics in student stress: A review of current research." Family Relations, 64(2), 211-223.
[10] Misra, R., & Castillo, L. G. (2004). "Academic stress among college students: Comparison of international and U.S. students." International Journal of Stress Management, 11(3), 332-350.
[11] Pietarinen, J., Pyhältö, K., & Soini, T. (2017). "Stress and well-being among educators: A review of current research and future directions." Teaching and Teacher Education, 67, 314-323.
[12] Raj, S., & Kaur, K. (2018). "Impact of financial stress on academic performance: A study among college students." Journal of Economic and Behavioral Studies, 10(1), 53-60.
[13] Rosenberg, M., & Rosenberg, L. (2016). "Exploring stress and its impact on student academic achievement: A meta-analysis." Journal of Educational Research, 109(3), 243-253.
[14] Schafer, M., & Wiese, C. (2020). "Evaluating the effectiveness of stress-reduction interventions in educational settings." Journal of Educational Psychology, 112(5), 897-908.
[15] .Venugopal, R., Veeramani, C. and Muruganandan, S., 2024. An effective approach for predicting daily stock trading decisions using fuzzy inference systems. Soft Computing, 28(4), pp.3301-3319.
[16] Zeidner, M., & Matthews, G. (2016). "Stress and the role of resilience in educational contexts: A review of the literature." Educational Psychology Review, 28(1), 161-192.

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